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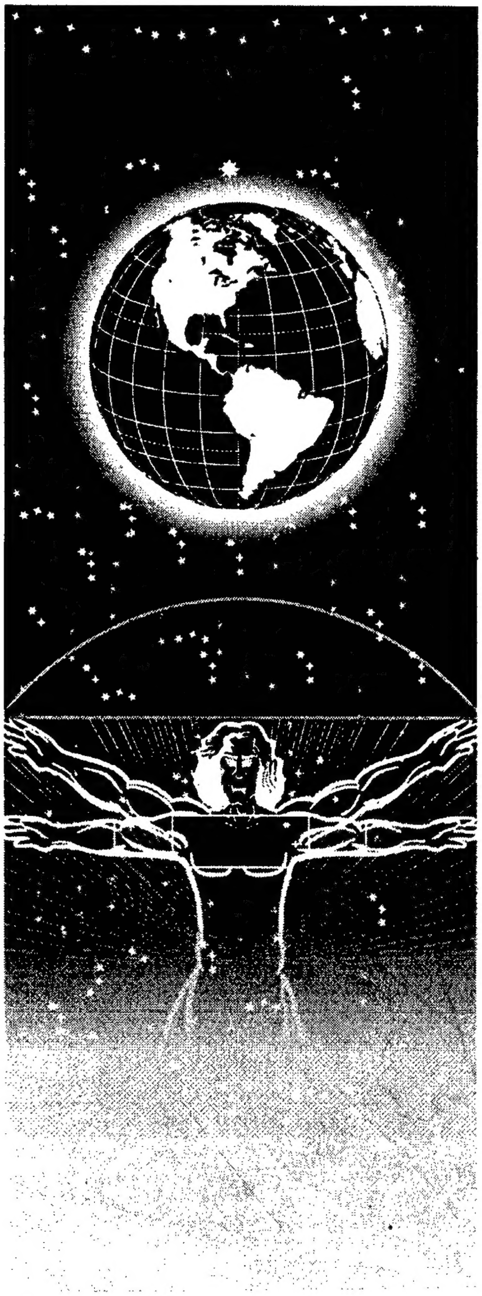

UNITED STATES AIR FORCE ARMSTRONG LABORATORY

Whiteman Air Force Base, Missouri Industrial Wastewater Treatment Plant Characterization and Analysis

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May 1997

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Personnel from the Armstrong Laboratory Water Quality Branch conducted an industrial wastewater treatment plant (IWTP) characterization and analysis at Whiteman Air Force Base, Missouri, 9-13 December 1996. The scope of the investigation was to determine the cause of existing operational difficulties with the IWTP. The IWTP analysis indicated unit operations were performing significantly below design expectations. The cause of the poor IWTP performance was determined to be related to the; 1) hydraulic and organic characteristics of the raw influent wastewater and 2) modifications of plant operation.

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Activated carbon filter   Aqueous film forming foam

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SECTION 1

INTRODUCTION

At the request of Mr. Gary Nault, Headquarters Air Combat Command, and the 509th Civil Engineering Squadron, Armstrong Laboratory/Occupational Environment Branch Water (AL/OEBW) visited Whiteman Air Force Base (AFB) with support from Mitretek Systems (AL/OEBW contractor) to observe and analyze the Whiteman AFB Industrial Wastewater Treatment Plant (IWTP). The site visit occurred 9 -13 December 1996 and was coordinated through the Whiteman AFB 509th CES/CEV. The principal Whiteman AFB points of contact for the AL/OEBW team were Mr. Jerry Whitford and Mr. Darrell Tackett. AL/OEBW team members on this project were Master Sergeant Mary Fields, Team Leader, and James Morgan, a Principal Engineer and Hydrologist for Mitretek Systems, Inc. The site visit was organized into three distinct activities that occurred during three consecutive days. The activities were:

1) initial familiarization with the base industrial operations and the domestic wastewater treatment plant,
2) site visits to some important shops generating industrial wastewater, and
3) observation and sampling of industrial wastewater at key locations within IWTP operations.

After completion of the above activities, the AL/OEBW Field Team made an initial assessment of problems and operations impacting the IWTP and developed preliminary results and recommendations. The initial field review results and recommendations were organized within an out-briefing outline. The out-briefing was held Friday, 13 December 1996 with interested parties at Whiteman AFB. The initial findings and IWTP assessment were reviewed at that time.

1.1 Purpose

The purpose of the site investigation activities at Whiteman AFB was to:

1) develop a general understanding of the Whiteman AFB industrial and wastewater treatment operations and capabilities,
2) identify and observe potential flight operations and wastewater discharges adversely impacting the IWTP,
3) identify and observe operations of the IWTP impacting worker safety or effluent quality, and
4) develop recommendations and/or a plan of action to address any issues having an adverse impact on the IWTP.

The purpose of the site visit was accomplished. Initial observations and recommendations from the AL/OEBW Field Team were provided to Whiteman Air Force Base personnel at the out-briefing. A copy of the AL/OEBW Field Team's out-briefing outline is provided as Appendix 1. The purpose of this report is to present follow up information developed as a result of the field investigation. An important function of this report is to integrate the sample data collected from the IWTP on 12 December 1996 and other written technical information obtained during the Whiteman AFB site visit with the observations and recommendations made during the visit. This approach will allow the 509th CES to develop decisions for managing and treating the industrial wastewaters generated by the current flight operations in a manner that will cause minimal disruption to other base operations.

1.2 Background

Whiteman AFB, Missouri is the home of the 509th Bomber Wing. The 509th Bomber Wing is comprised of the most technically advanced and sophisticated airplane in the world, the B-2 Stealth Bomber. An A-10 fighter squadron and helicopters are also located at Whiteman AFB. Prior to these new air wings' location at Whiteman AFB, the primary base occupant was the 351st Missile Wing. The location of the new air wings at Whiteman AFB has impacted a large number of base operations that generate industrial wastewater. Sverdrup Corporation conducted an industrial wastewater pretreatment survey in the spring of 1995. The base's primary occupant during the 1995 pretreatment survey was still only the 351st Missile Wing. Operations supporting the mission of the B-2 Stealth Bomber generate wastewaters containing many contaminants not historically associated with the industrial activities on Whiteman AFB. Addition of the A-10 fighterwing has resulted in additional jet engine maintenance activity and plane washing wastes. Consequently, the hydraulic and organic characteristics of industrial wastewater at Whiteman AFB have changed since the original IWTP was designed.

The new 509th mission has had many impacts. One impact of the new mission is heightened concern for worker safety. Many components used for construction and maintenance of the B-2 are hazardous materials. As such, special training and medical monitoring has been provided for some workers that could be exposed to chemical hazards. Workers at the IWTP have not been subjected to an annual medical monitoring program designed to monitor exposure to chemical hazards. Odors similar to rotten eggs or hydrogen sulfide have been reported by many plant operators. Some workers believe headaches and fatigue they experience may have been related to the odors. A health and safety incident occurred at the facility in August 1994 that resulted in plant shut down. Employees experienced acute respiratory tract irritations which required medical attention. A concern for personal safety at the IWTP has been generally expressed by many parties involved with the industrial wastewater treatment operations. The adequacy of industrial wastewater pretreatment and questioning of the need for industrial treatment facilities had also become issues because suspension of the IWTP operations since

September 1996 had not resulted in an apparent effluent violation of the National Pollutant Discharge Elimination System (NPDES) permit governing discharges from the Federally Owned Treatment Works (FOTW). This background information was very useful to the AL/OEBW Field Team when evaluating actual operations.

1.3 Overview of Industrial Operations

The principal industrial operations at Whiteman AFB are associated with support of the 509th Bomber Wing. Flight operations and maintenance in support of the A-10 fighter wing and a helicopter squadron are also believed to significantly impact the characteristics of the industrial wastewater at the base. Typical industrial activities performed at Whiteman AFB are:

- jet engine maintenance and repair,
- non-destructive structural inspection activities,
- routine airframe maintenance,
- plane fueling operations,
- petroleum storage,
- hydraulic maintenance,
- plane washing,
- aircraft deicing,
- Aircraft ground equipment (AGE) operation and maintenance,
- corrosion control,
- electrical equipment and instrument maintenance,
- equipment testing,
- refueling vehicle maintenance,
- photographic development laboratory,
- fire protection and fire protection hydrant testing,
- vehicle and AGE washing,
- floor cleaning in shops and hangars, and
- other routine aircraft maintenance activities.

Wastewater generated from these industrial activities is generally believed to be similar to the wastewater generated from comparable activities at other Air Force facilities.

1.4 Description of Industrial Wastewater Treatment

The Whiteman AFB industrial wastewater treatment system is comprised of six primary elements. The design and construction of the system was initiated before any B-2s were operational. Most of the industrial treatment facilities were designed during the 1991 time period. The primary industrial wastewater treatment elements are the: 1) industrial wastewater pretreatment units (e.g., oil/water separators), 2) industrial

wastewater collection system, 3) aqueous film forming foam (AFFF) surge facilities, 4) industrial waste equalization facilities, 5) the IWTP, and 6) the FOTW. Each element serves an important purpose with respect to the conceptual design and operation of the industrial wastewater treatment system.

The principal design function of each element is:

- industrial wastewater pretreatment units (e.g., oil/water separators) are in place to remove shock loads of oil and grease or suspended solids,
- the collection system conveys the industrial wastewater from its source to the IWTP for initial treatment,
- the AFFF surge facility provides temporary storage for high oxygen-demanding wastes associated with fire protection,
- equalization facilities normalize extreme variances of hydraulic and organic wastewater characteristics,
- the IWTP provides the principal pretreatment for industrial wastes to ensure compliance, and
- the FOTW primarily treats domestic sewage for compliance with NPDES Permit No. MO-0029378, but it also provides a secondary or last option capability to treat industrial wastewater and ensure permit compliance at a point of discharge to waters of the State of Missouri.

A map of the Whiteman AFB industrial area, IWTP, and flight line area is presented as Figure 1.

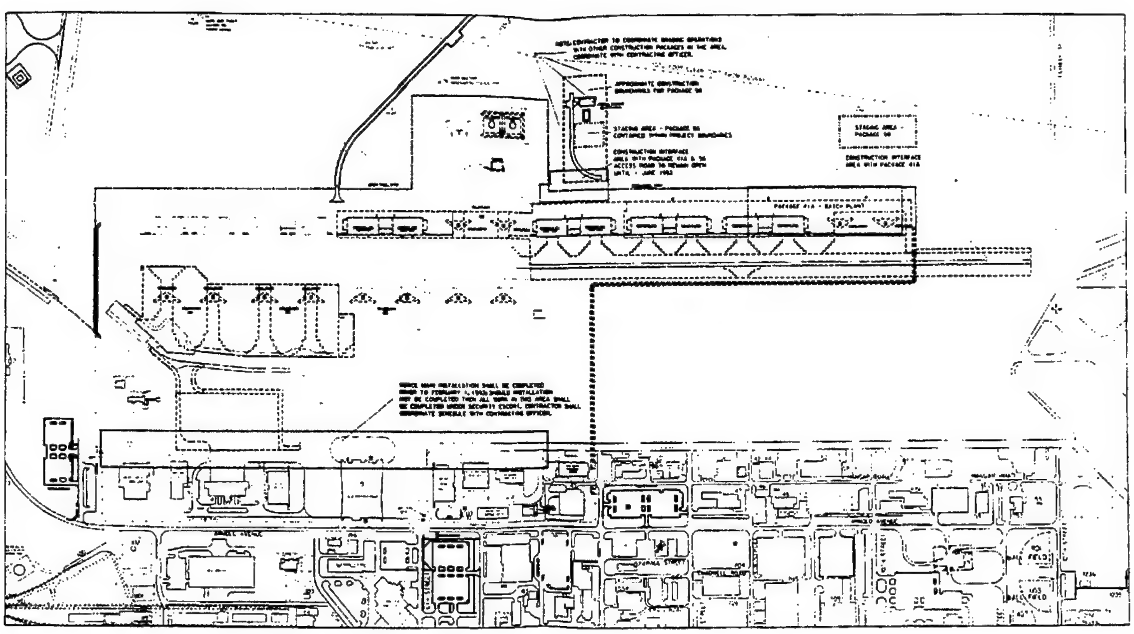


Figure 1: Whiteman AFB Industrial Area, IWTP and Flight Line

1.5 Problem Summary

Many questions and uncertainties concerning operation of the IWTP have been raised by managers and workers at Whiteman AFB. Some of the more critical issues are:

- Workers are concerned that they are exposed to unknown chemical hazards at the IWTP that may affect their health.
- There is no certainty of the industrial wastewater character at Whiteman AFB.
- The impact of individual industrial shops at the base on environmental operations is not adequately known.
- Management is concerned industrial wastes may cause the FOTW to not comply with the NPDES discharge limitations.
- Are there odors at the IWTP and, if so, what are they?
- Does the IWTP work effectively?
- Is the IWTP actually needed?
- How can wastewater foaming be prevented?
- Will an oil/water separator eliminate any remaining industrial wastewater problems?

Not all of the concerns listed above can be addressed by an engineer or field investigation. Some issues, such as those dealing with worker health, are best assessed by physicians and industrial hygienists. However, most of the concerns raised about the Whiteman AFB industrial wastewater treatment system can be addressed by a systematic engineering evaluation of the industrial waste system.

1.6 Approach

The AL/OEBW Field Team used a systematic approach to assess the industrial wastewater system. The approach is outlined below.

- The initial step was to become familiar with the general wastewater permits and discharge requirements imposed on the base.
- A second step was to develop an understanding of the basic design and operational capabilities of the wastewater treatment facilities.
- The third step was to characterize the industrial processes and operations generating wastewater.
- Industrial waste samples were collected and observations of the industrial treatment plant operations were made to determine what was working and what was not.
- Finally, all the information was integrated and analyzed as a system to assess what is known, what changes need to be made, and what information is needed to address unanswered issues.

SECTION 2

INDUSTRIAL WASTEWATER UNIT DESCRIPTION, OPERATION ANALYSIS, SAMPLE DATA and OBSERVATIONS

The AL/OEBW Field Team reviewed the FOTW, the IWTP, and several industrial shops during their site visit. Numerous reports (e.g., IWTP Design Specifications Bid Package, IWTP Unit Operation Manuals, NPDES Self Reporting Data), observations and photographs of activities and issues impacting the industrial waste treatment system were collected. This information has been used to understand and assess the operation of the individual industrial wastewater units as elements of a system. IWTP operations were unexpectedly initiated for one day during the field teams site visit. Several sets of industrial wastewater samples were collected by the AL/OEBW Field Team. The analytical data obtained from the sample analysis has helped facilitate evaluation of the plant operations.

The industrial wastewater units discussed in this section are: 1) base operations generating industrial wastewater, 2) the FOTW, and 3) the IWTP individual operating units. Both base operations and the FOTW have many individual shops or operating treatment process components, but for purposes of information management in this report they are addressed as a whole operating unit. However, the IWTP treatment process components are addressed individually. Industrial waste systems not visited by the AL/OEBW Field Team (e.g., AFFF Surge Tank, main industrial shops) are not discussed.

This section of the report: 1) identifies the operations units reviewed, 2) briefly describes their function or design, 3) presents sample data developed by the AL/OEBW Field Team, 4) describes observations related to the unit operations, 5) presents photographs of important issues or observations, 6) and, for some units, develops an initial analysis of information necessary to assess the industrial wastewater system as a whole.

2.1 Characteristics of Base Operations and Industrial Wastewater

Base operations and wastewater character have changed dramatically since Sverdrup Corporation designed the IWTP. Because the mission of the 509th Bomb Wing is so unique and had not been previously performed, the actual characteristics of today's industrial wastewater stream is not reflective of the one anticipated. In general, more constant volume and uniform high strength industrial wastewaters were anticipated by the IWTP design team than were actually observed and sampled on 12 December 1996. Observations of the AL/OEBW Field Team at the Structural Maintenance and Corrosion Control shops indicate that water conservation and pollution prevention (P^2) practices in

coordination with an effective environmental management system have had a positive impact on both the volume and strength of industrial wastewaters generated by these shops. Although, some P^2 improvements can still be made at these shops, observed operations generally minimized wastes. Good environmental management practices are likely responsible for the industrial wastewater characteristics that AL/OEBW personnel observed. The observed industrial wastewater was comparable to domestic sewage in strength. Additional information developed by the AL/OEBW Field Team through interviews with base personnel indicate that base operations most likely to impact industrial wastewater character significantly are fire protection and testing and petroleum spills or environmental incidents that surge or create immediate organic and hydraulic loads.

Fire protection training and hydrant testing can generate hydraulic surges (volumes estimated at 100-250,000 gallons by base personnel) of industrial wastewater containing three (3) and six (6) percent AFFF. Wastewater containing AFFF can foam in a manner that presents health, safety or operations problems. For example, wastewater foam can overflow a tank or treatment unit and short circuit an electrical motor or panel. Furthermore, three (3) percent AFFF is reported to have a BOD_5 of 20,000 mg/l. Whiteman AFB workers reported that volumes of AFFF >100,000 gallons are sometimes generated during fire hydrant testing periods. A fire hydrant test generating 100,000 gallons of three (3) percent AFFF can potentially exert an oxygen demand of 16,680 pounds. The FOTW daily maximum capacity for treatment of BOD_5 is approximately 5,000 pounds. An organic waste demanding several times the daily organic treatment capacity of the FOTW could produce a bacterial kill at the domestic wastewater treatment plant that would result in NPDES non-compliance for an extended period of time. Large fuel spills (e.g., >1,000 gallons JP4) could similarly damage the Whiteman AFB FOTW. Industrial wastewater with hydraulic surges of AFFF or petroleum hydrocarbons pose a potential threat to the performance of the FOTW. Figure 2 is presented to indicate a degree of foaming possible at the plant. The foam is estimated to be 15-20 feet thick.

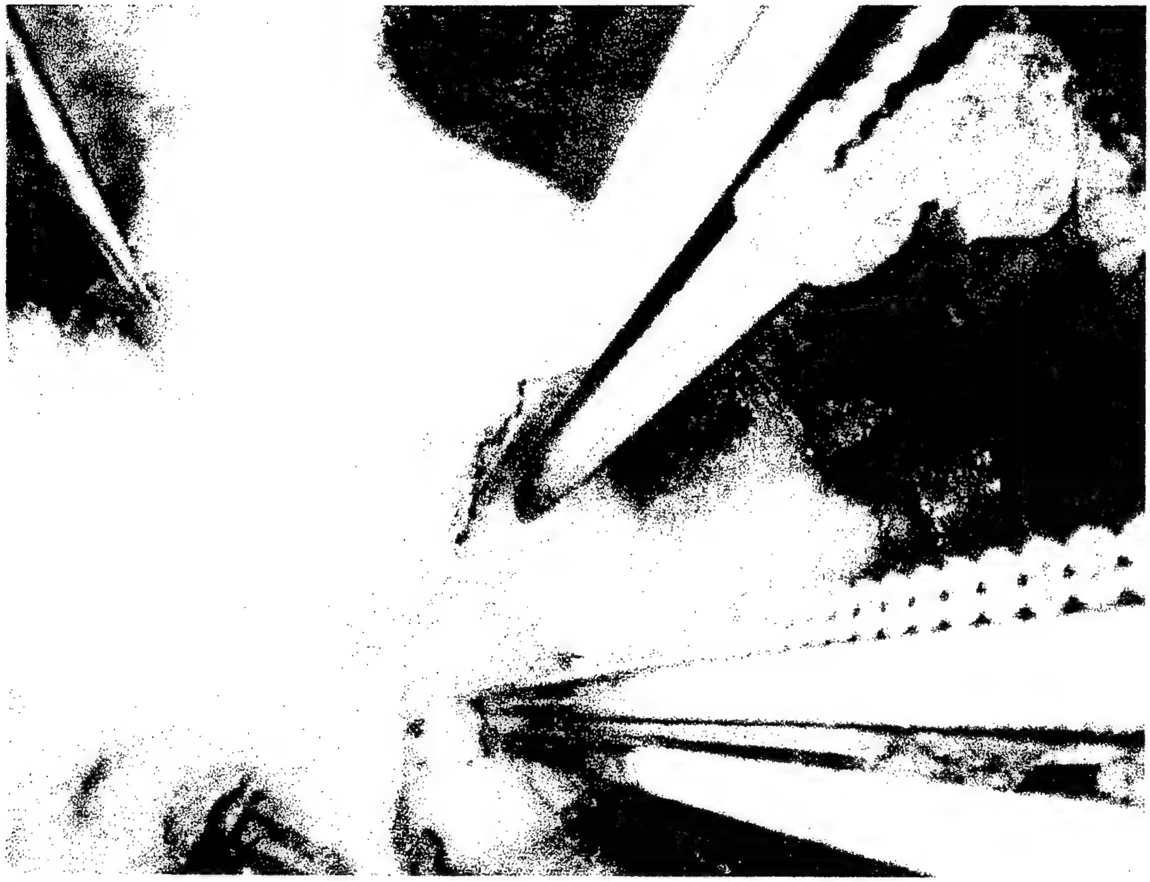


Figure 2: Influent wet well and lift station at the IWTP frequently experiences foaming. Photograph taken 12/12/96

2.2 Federal Owned Treatment Works (FOTW)

The Whiteman AFB FOTW is regulated by NPDES Permit No. M0-0029378. A copy of the FOTW permit is provided as Appendix 2. More stringent permit limits begin to apply to this facility beginning 1 June 1997. The domestic wastewater treatment plant units consist of: 1) a comminutor, bar screen and grit chamber, 2) two primary clarifiers, 3) two rock media trickling filters, 4) two final clarifiers, 5) chlorination facilities, 6) two anaerobic digestors, 7) sludge filter press, and four wetlands wastewater polishing ponds. Peak design flow permitted at the FOTW is 2.19 MGD. Interviews with the FOTW plant operators revealed that aside from foaming and occasional petroleum spills, industrial wastewater influents do not generally create operational or NPDES permit compliance problems. An informal AL/OEBW review of the FOTW effluent discharge records confirmed that no effluent violations had occurred during the past quarter. Presented in Table 1 are the permitted NPDES general effluent discharge limitations for the FOTW that will soon come into effect.

Table 1: NPDES Permit No. MO-0029378 Effluent Discharge Limitations, Effective Date: 1 June 1997				
Parameter	**Unit**	**Daily Max.**	**Weekly Avg.**	**Mo. Avg.**
Flow	MGD	2.19		1.26
BOD_5	mg/l			
June 1-Sept.30			15	10
Oct. 1- May 31			20	15
C.O.D.	mg/l			
June 1-Sept.30		90		60
Oct. 1- May 31		120		90
T. Susp. Solids	mg/l		20	15
Oil/Grease	mg/l	20		15
pH	SU			
Temperature	^{0}F			
Total Copper	mg/l	.043		.043
Total Lead	mg/l	.020		.020
Total Zinc	mg/l	.150		.150
Cyanide	mg/l	.022		.022
Total Phenol	mg/l	.100		.100
Total Silver	mg/l	.0082		.0082
Ammonia as N				
June 1-Sept.30	mg/l	3		2
Oct.1-May 31	mg/l	4.5		3.5

A review of the most recent FOTW quarterly effluent discharge records also confirmed compliance with the more stringent limitations that begin in 1997. However, the new BOD_5 effluent daily average limit will be 10 mg/l for the most stringent period of 1 June through 30 September and the actual average FOTW effluent BOD_5 for the period 1 September through 30 November 1996 was 9.5 mg/l. The difference between the new permitted value and the average monthly BOD_5 is only .5 mg/l BOD_5. Trickling filter treatment plants, such as this FOTW, typically cannot remove BOD_5 below 5 mg/l. The estimated average influent BOD_5 load that should ensure compliance with the new effluent limitations under normal operating conditions is approximately 3,150 pounds BOD_5 per day. The fall quarterly average influent BOD_5 load was approximately 760 pounds BOD_5 per day. Although the difference between operating load capacity and actual load capacity is large, a safety buffer is not provided since shock loads can disrupt sensitive biological wastewater treatment systems. The AL/OEBW Field Team toured the FOTW on 10 December 1996. Observations showed the plant was very well maintained and in good operating condition

Table 2: 12 December 1996, Whiteman AFB, Mo. Industrial Wastewater Treatment Plant Sample Analysis Data

Sample Location	Time hr.	BOD5 mg/l	COD mg/l	TOC mg/l	TPH mg/l	Oil and Grease mg/l	Arsenic mg/l	Cadmium mg/l	Chromium mg/l	Copper mg/l	Lead mg/l	Mercury mg/l
EPA MCL's							0.05	0.01	0.2	1	0.05	0.002
Influent												
	0	180.000	170.000	30.000	72.000	83.200	0.005	0.002	0.010	0.042	0.020	0.000
	2	120.000	240.000	35.000	64.000	88.800	0.005	0.001	0.010	0.020	0.020	0.000
	4	120.000	300.000	25.000	48.000	64.000	0.005	0.001	0.010	0.020	0.020	0.000
12/12/96 Avg. Conc.		140.000	236.667	30.000	61.333	78.667	0.005	0.001	0.010	0.027	0.020	0.000
Clarifier Effluent												
	0	68.000	140.000	44.000	44.000	51.200	0.005	0.001	0.010	0.036	0.020	0.000
	2	76.000	10.000	25.000	56.000	70.400	0.006	0.001	0.010	0.020	0.020	0.000
	4	62.000	180.000	25.000	8.000	11.200	0.007	0.001	0.010	0.020	0.020	0.000
12/12/96 Avg. Conc.		68.667	110.000	31.333	36.000	44.267	0.006	0.001	0.010	0.025	0.020	0.000
DAF Effluent												
	0	69.000	200.000	35.000	272.000	400.000	0.005	0.001	0.010	0.020	0.020	0.003
	2	71.000	20.000	20.000	70.400	72.000	0.005	0.001	0.010	0.020	0.020	0.000
	4	72.000	60.000	20.000	14.400	16.000	0.005	0.001	0.010	0.020	0.020	0.000
12/12/96 Avg. Conc.		70.667	93.333	25.000	118.933	162.667	0.005	0.001	0.010	0.020	0.020	0.001
ACC Filter Effluent												
	0	30.500	1130.000	445.000	72.000	88.000	0.017	0.282	0.287	0.296	0.968	0.000
	2	30.500	150.000	125.000	16.000	27.200	0.007	0.001	0.010	0.020	0.020	0.000
	4	31.000	340.000	50.000	80.800	88.000	0.005	0.001	0.010	0.020	0.020	0.000
12/12/96 Avg. Conc.		30.667	540.000	206.667	56.267	67.733	0.010	0.095	0.102	0.112	0.336	0.000
IWTP System Eff.												
		78.095	-128.169	-588.889	8.261	13.898	-93.333	-7000.000	-923.333	-309.756	-1580.000	0.000

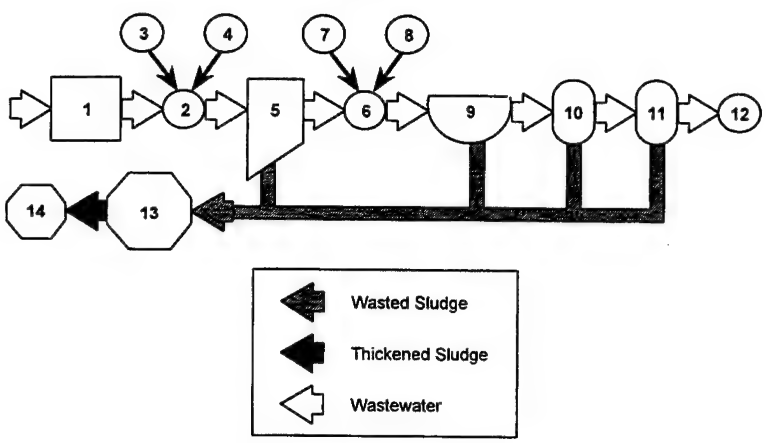
Sample Location	Time hr.	Nickel mg/l	Selenium mg/l	Sodium mg/l	Aluminum mg/l	Iron mg/l	Mag. mg/l	Mang. mg/l	Moly. mg/l	Pottasium mg/l	Silver mg/l	Zinc mg/l	T. H. Metal mg/l
EPA MCL's		-	0.01	-	-	0.3	-	0.05	-	-	0.05	5	
Influent													
	0	0.020	0.005	110.300	1.200	0.997	48.200	0.993	0.030	10.997	0.010	0.062	1.169
	2	0.020	0.005	110.300	0.953	0.724	43.543	0.851	0.030	10.323	0.010	0.062	1.004
	4	0.020	0.005	121.900	0.809	0.597	46.115	0.929	0.030	11.805	0.010	0.050	1.070
12/12/96 Avg. Conc.		0.020	0.005	114.167	0.987	0.773	45.953	0.924	0.030	11.042	0.010	0.058	1.081
Clarifier Effluent													
	0	0.020	0.005	363.600	1.750	0.709	28.650	0.180	0.030	15.551	0.010	0.101	0.388
	2	0.020	0.005	355.850	0.631	0.252	25.637	0.142	0.030	14.387	0.010	0.010	0.244
	4	0.020	0.005	330.178	0.052	0.047	29.611	0.068	0.030	13.540	0.010	0.050	0.211
12/12/96 Avg. Conc.		0.020	0.005	349.876	0.811	0.336	27.966	0.130	0.030	14.493	0.010	0.054	0.281
DAF Effluent													
	0	0.020	0.005	415.080	2.580	1.353	23.044	0.202	0.030	15.889	0.010	0.044	0.340
	2	0.020	0.005	384.350	0.655	0.302	29.535	0.128	0.030	15.469	0.010	0.050	0.269
	4	0.020	0.005	343.170	0.159	0.110	28.808	0.086	0.030	13.373	0.010	0.050	0.227
12/12/96 Avg. Conc.		0.020	0.005	380.867	1.131	0.588	27.129	0.139	0.030	14.910	0.010	0.048	0.279
ACC Filter Effluent													
	0	0.314	0.005	573.160	0.552	0.518	53.233	0.370	0.258	16.177	0.221	0.315	3.075
	2	0.020	0.005	442.669	0.231	0.180	31.408	0.142	0.030	15.230	0.010	0.050	0.285
	4	0.020	0.005	383.020	0.204	0.064	25.490	0.073	0.030	13.930	0.010	0.050	0.214
12/12/96 Avg. Conc.		0.118	0.005	466.283	0.329	0.254	36.710	0.195	0.106	15.112	0.080	0.138	1.192
IWTP System Eff.													
		-490.000	0.000	-308.423	66.678	67.127	20.113	78.904	-253.333	-36.866	-703.333	-138.506	-10.205

2.3 Sample Data Collected from the IWTP 12 December 1996

The contents (estimated at 150,000 gallons) of the IWTP equalization basin were treated at the IWTP 12 December 1996. This event had not been planned for by the AL/OEBW Field Team, but represented an opportunity to collect samples of the IWTP operations and partially characterize the industrial wastewater. Samples were collected at three different intervals of the influent, clarifier effluent, DAF effluent and the final IWTP effluent from the Activated Carbon Filter before recycle to the IWTP equalization basin. Except for BOD_5 analyses all samples were analyzed by Armstrong Laboratories at Brooks Air Force Base, Texas (BAFB) and the results are tabulated in Table 2. The samples collected for BOD_5 were analyzed by the Whiteman AFB FOTW laboratory. The Armstrong Laboratory Sample Analysis Data Sheets are provided in Appendix 2. Operations analysis of the sample data with respect to individual IWTP units or treatment processes is presented in this section of the report. Analysis of the sample data with respect to the broader industrial wastewater system is presented in Section 3.

2.4 Base Industrial Wastewater Treatment Plant

The treatment components of the Whiteman AFB IWTP are an inclined plate clarifier, pH adjustment, dissolved air flotation, sand filters, activated carbon filters, sludge thickener, sludge filter press and effluent recycle capability. A simplified flow chart of the industrial wastewater treatment process units is provided as Figure 3. The average design flow rate or design hydraulic loading of these facilities is 60 gpm or 86,400 gpd during continuous twenty-four hour operation.



Identification Key of Numerical Operating Units

1 Equalization Basin
2 Mixer
3 NaOH pH Adjustment
4 Nalco defoaming polymer
5 Inclined Plate Clarifier
6 Mixer
7 H_2SO_4 pH Adjustment
8 Alum Addition
9 Dissolved Air Flotation Unit
10 Sand Filters (2 in series)
11 Activated Carbon Filter (2 in series)
12 FOTW Sewer System
13 Sludge Handling and Storage
14 Sludge Filter Press

Figure 3: Simplified Process Flow Chart of the Whiteman AFB IWTP

After completion of the site visit, the AL/OEBW Field Team reviewed numerous records and documents concerning the FOTW and IWTP operation and design. During the post site visit document review of the *B-2 Support Facilities Industrial Wastewater Treatment Facility Construction Specifications and Bid Documents* the fundamental IWTP design basis assumptions were identified. The *"as built"* IWTP design assumptions are presented in the following table.

Table 2: "As Built" IWTP Design Basis				
Contaminant or Design Parameter	Influent Concentration mg/l	Waste Load mg/l	Effluent Treat. Objective	Treatment Unit
Max. flow (system)		220 gpm	N/A	
Average flow		60 gpm	N/A	
pH			N/A	
Biochemical Oxygen Demand			N/A	
AFFF* (BOD_5)	2,000			AFFF* surge
Chemical Oxygen Demand				
Suspended Solids	1,000	720	<1	clarifier
Heavy Metals	200	144	<10	clarifier
Oils/Grease	2,000	1,441	<10	DAF**
Fuels	100	72	<10	DAF**
Emulsified Oils	500	360	<10	DAF**
Solvents	500	360	<10	Carbon Filter
Phenols	25	18	<10	Carbon Filter

• Aqueous Film Forming Foam
** Dissolved Air Flotation

Identification of the design specifications were necessary for the AL/OEB field team to perform the systematic engineering evaluation of both the IWTP process units and the industrial wastewater system.

2.4.1 Equalization Basin

The equalization basin consists of a square underground concrete vault and dual pump lift station adjacent to the IWTP building. The purpose of the unit is to normalize hydraulic and organic contaminant fluctuations within the influent of the IWTP. The hydraulic capacity of the equalization basin is approximately 150,000 gallons. One potential problem with this unit is its size. An equalization basin is designed to mix and normalize operating conditions. Normal operation of the IWTP is eight to twelve hours per day or expressed in hydraulic terms, 28,800 gpd to 57,600 gpd. Industrial flows in this range will tend to flow as "plugs" through the basin and not normalize contaminant fluctuations effectively. When IWTP operations are continuous, residence time in the equalization basin will be approximately 1.75 days. Confined quiescent (> 3 hours

residence) wastewaters, such as those held in the equalization basin, will frequently turn septic and generate noxious odors and gases that are highly corrosive to concrete.

Other items of concern related to this unit that were raised by IWTP operators were foaming and septic conditions that produce strong "rotten egg" odors. Both of these concerns indicate septic conditions occur within the equalization basin. Significant foaming was observed by the AL/OEBW Field Team at the influent wet well (See Figure 2) and hydrogen sulfide (H_2S) gas was also measured with a Draeger tube at atmospheric concentrations >50ppm. According to Irving Sax, the lethal inhalation concentration of H_2S is 600 ppm for thirty minutes. H_2S concentrations in the range of 20-250 ppm are serious irritants to the eyes and respiratory system. The asphyxiant action of the compound is due to paralysis of the respiratory center. Some health risks are posed at the unit from H_2S gas.

An additional observation of the AL/OEBW Field Team at this unit concerns safety. The manway entrances to the equalization basin were unlocked and the ladders lead to confined spaces. The entrance manways should be locked to prevent unauthorized entrance to the unit.

2.4.2 Inclined Plate Clarifier

The inclined plate clarifier performed well on 12 December 1996 with respect to observed removal of suspended solids. The unit is a package system manufactured by Atlantes Chemical Systems. The unit design is for removal of metals and settleable solids.

Minor foaming was observed occasionally, but did not cause any observable operations problem. The flash mixer at the influent chamber of the unit had previously been modified by the plant operator with a slower rpm mixer in order to reduce foaming. Mixing performance would be improved by locating the replacement mixer more central to the influent flow path. Addition of NaOH and an anionic polymer caused an effective flock to form and the flock was observed to settle readily in the settling chamber of the clarifier. Suspended solids removal was not analytically determined, but was visually observed to be effective.

At Whiteman AFB, metals precipitation is the primary contaminant of removal interest with respect to the design of the clarifier. Consequently, wastewater samples were principally collected for heavy metals analysis during its operation 12 December 1996. The addition of the anionic polymer and pH adjustment to near 10.0 is performed in the flash mix tank to optimize metals removal in the settling basin. Samples were collected from both the influent and effluent of the clarifier. The analytical data is presented in Table 4.

Table 4: Clarifier Performance 12 December 1996												
Time	BOD_5			COD			Oil/Grease			Heavy Metals		
	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%
0 hour	180	68	62	170	44	18	83	51	38	1.17	.38	67
2 hours	120	76	37	240	25	96	89	70	21	1.00	.24	76
4 hours	120	62	48	300	25	40	64	11	82	1.07	.21	80
Average	140	69	51	237	31	**53**	79	44	44	1.08	.28	**73**

Analysis of clarifier performance indicates that the unit was reasonably efficient (73 % removal efficiency for metals) in reducing the primary contaminants it was designed to remove. The influent heavy metals loading was less than one percent of the design load capacity. A removal efficiency of 73 percent at such a low influent load is adequate. Non-target contaminants (i.g., BOD_5, COD, Oil/Grease) were also reduced.
Figure 4 is presented to indicate the effluent quality from the clarifier with respect to suspended solids removal.

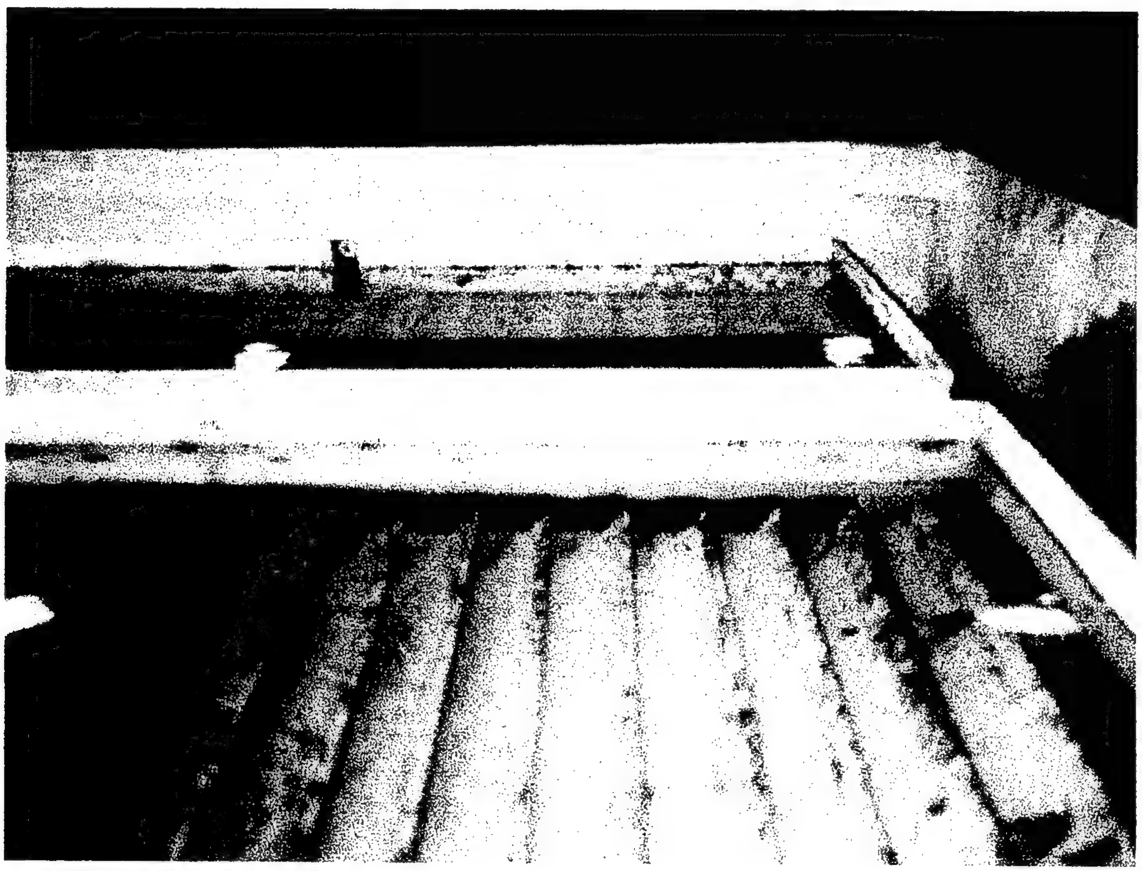


Figure 4: Effluent from the IWTP inclined plate clarifier was essentially free of flock and suspended solids. Photograph taken 12 December 1996.

2.4.4 Dissolved Air Flotation Unit

The primary contaminant to be removed by the Dissolved Air Flotation (DAF) unit is petroleum oils and fuel. Influent to the DAF system is the clarifier effluent. A mixing tank pretreats the incoming wastewater to the DAF. The purpose of pretreatment is to adjust the pH to neutral and to optimize surface tension conditions to assist oil and grease removal. Aluminum sulfate is added in the mixing tank as a foaming agent to aid formation of a floating oily film or foam. The DAF unit was installed as a package element of the IWTP. Several times during the day of operation strong sulfide odors were detected by the AL/OEBW Field Team in the vicinity of the DAF. On two separate occasions Draeger tube samples were collected to monitor for H_2S. A concentration of 5 ppm H_2S was measured at the DAF after approximately two hours of operation. H_2S may be released from wastewater solutions at the DAF by the addition of sulfuric acid (H_2SO_4) for pH neutralization. Design pH adjustment specified the use of hydrochloric acid (HCl). Future operations of this unit should adjust pH using the design acid. HCL reactions in wastewater will produce table salt (NaCl) when reacted with NaOH, the compound that adjusts pH for optimum clarifier operations. Use of H_2SO_4 reacts with NaOH to form Na_2S, a compound that degrades to H_2S in acid conditions such as those in the DAF. Figure 5 is a photograph of the effluent from the DAF.

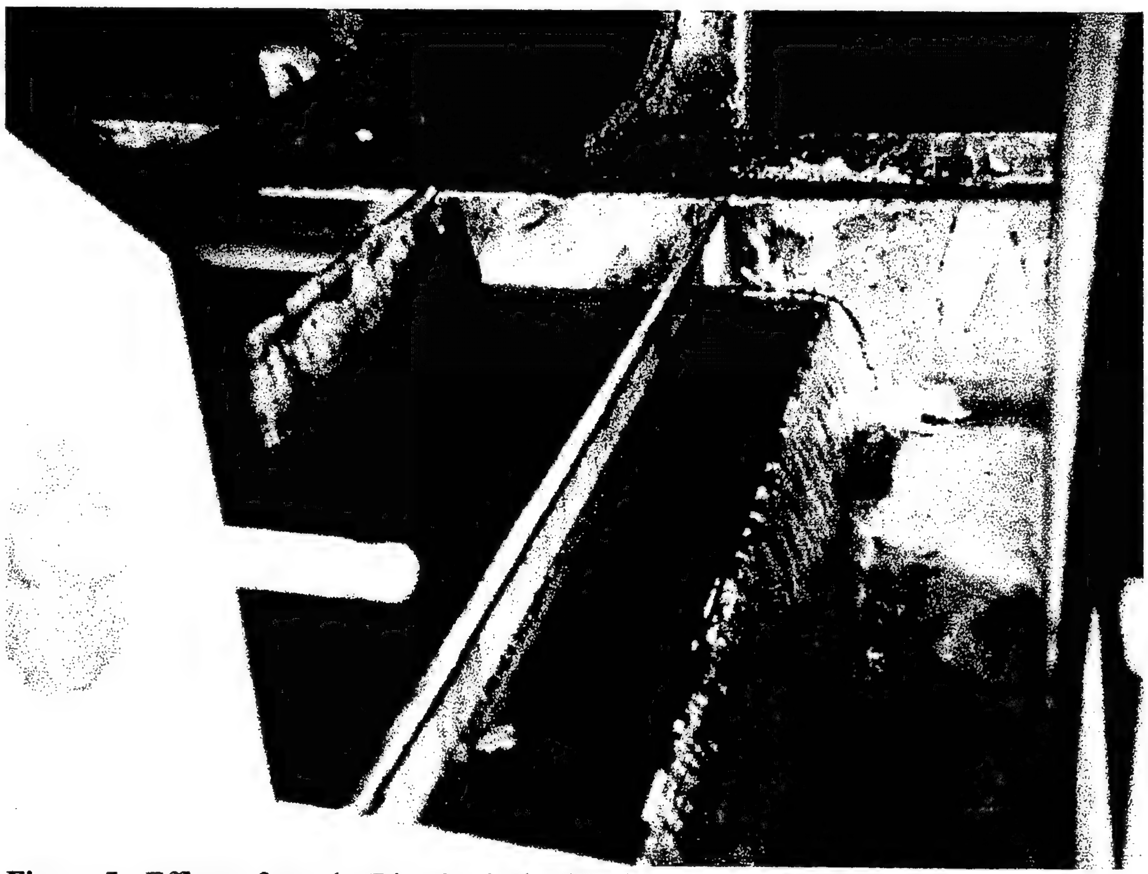


Figure 5: Effluent from the Dissolved Air Flotation unit was free from any observable floating oils/greases on 12 December 1996. Photograph taken 12 December 1996.

No visually apparent oils and greases were observed to be present in either the influent or effluent of the DAF. After four hours of operation the effluent was opaque and white, but no visual indication of oil/grease was present. The discoloration may have been the result of excessive aluminum sulfate addition during pretreatment or a "wastewater plug" containing soap or water soluble solvents. Samples collected of the DAF influent and effluent are presented in Table 5.

Table 5: DAF Performance 12 December 1996

Time	BOD_5			COD			Oil/Grease			Heavy Metals		
	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%
0 hour	68	69	-1.5	44	200	-43	51	400	-681	.38	.34	12
2 hours	76	71	6.6	25	20	20	70	72	-2	.24	.27	-10
4 hours	62	72	-16	25	60	-140	11	16	-42	.21	.23	-7
Average	69	70	-3	31	93	-54	**44**	**163**	**-267**	.28	.28	-2

Although no visual oils and greases were observed at the DAF by the AL/OEBW Field Team, significant oil and grease was present. Each DAF sample interval also indicated a significant amount of oil and grease was present in the effluent. Analysis of treatment performance indicates the DAF provided no treatment for the contaminant of interest. Average wastewater flow through the unit resulted in a large increase of oil and grease in the units effluent. Poor DAF unit performance on the day of observation is attributed by the AL/OEBW Field Team to unit start up, "wastewater plugs" of soap or solvents containing soluble oils and greases, and unknowns.

2.3.4 Sand and Activated Carbon Filters

The IWTP sand and activated carbon filters are fully contained systems. No "real time" visual observations of these systems operation can be made, aside from inspection of the influent and effluent. The two sand filters and two activated carbon filters are package systems manufactured by Vulcan Industries. Sand filters were specified to additionally polish or remove any solids remaining in the wastewater after treatment by the clarifier and DAF. This IWTP design feature will prevent short circuiting due to solids build up within the activated carbon units. Activated carbon filters were incorporated within the design at Whiteman AFB specifically to remove organic and phenolic contaminants. At Whiteman AFB these two pairs of filters can be operated in series or parallel. On 12 December 1996 they were operated in series. Series operation usually maximizes contaminant removal efficiencies in these type filters. Strong odors of H_2S were frequently noted near the activated carbon filter. One Draeger tube sample indicated atmospheric H_2S concentrations in the range of 12-15 ppm were present. Figure 6 is a photograph of the sand and activated carbon filters.

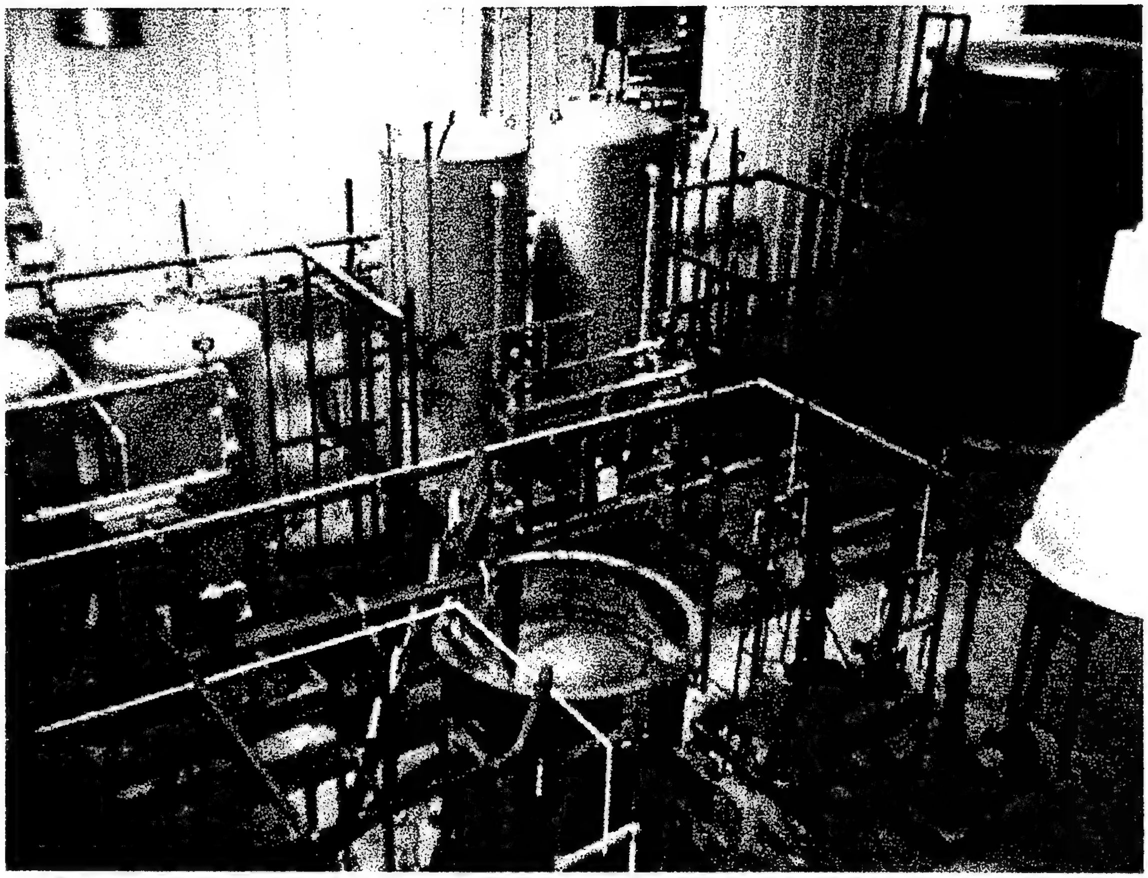


Figure 6: The sand and activated carbon filters at the Whiteman AFB IWTP.

Table 6 presents the analytical data collected from the influent and effluent samples of the sand and activated carbon filters by the AL/OEBW Field Team on 12 December 1996.

Table 6: Sand And Activated Carbon Filter Performance 12 December 1996												
Time	BOD_5			COD			Oil/Grease			Heavy Metals		
	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%
0 hour	69	31	55	200	1130	-465	400	88	78	.34	3.07	-803
2 hours	71	31	56	20	150	-650	72	27	62	.27	.29	-7
4 hours	72	31	57	60	340	-467	16	88	-450	.23	.21	7
Average	71	31	56	**93**	**540**	**-480**	163	68	58	.28	1.19	-325

Operating efficiency of the filter units was very poor. Average chemical oxygen demand (COD) treatment efficiency was -480 percent. Sample results indicate that breakthrough adsorption capacity had probably occurred in the activated carbon filters.

2.4.5 Sludge Handling Facilities

The sludge handling facilities at the plant consist of a sludge thickener tank and a sludge filter press. The sludge handling systems are well maintained and were not in operation during the AL/OEBW Field Team site visit. No significant problems were observed or reported concerning the sludge handling facilities.

2.3.6 Other Observations

Additional AL/OEBW Field Team observations relating to the IWTP were noted. They are discussed with Figures 7, 8 and 9 presented below.

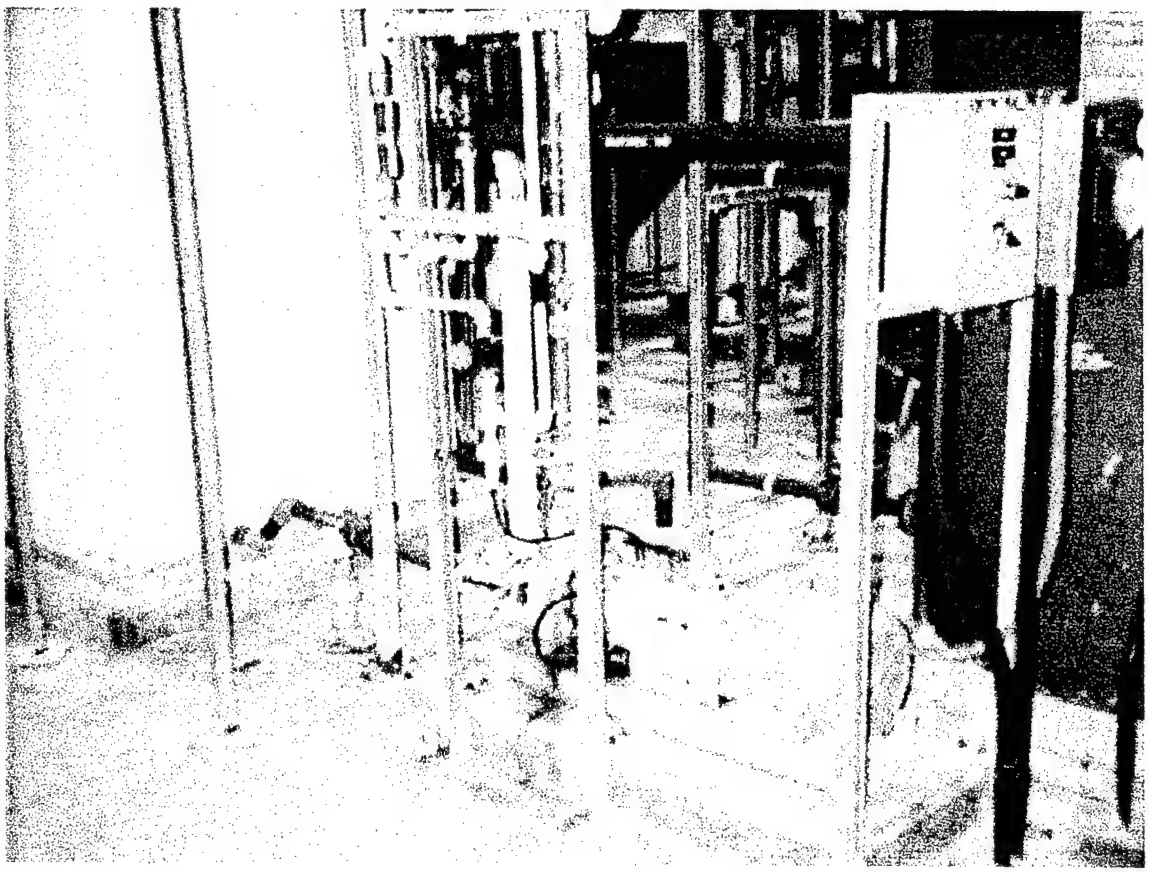


Figure 7: Some fittings and valves have corroded in the IWTP. Much of the corrosion appears to be induced by galvanic forces where dissimilar metals, such as black iron and galvanized supports, are in contact. All brass and copper fittings in the IWTP building are black from oxidation with H_2S. Examples of both these processes are observable in this photograph.

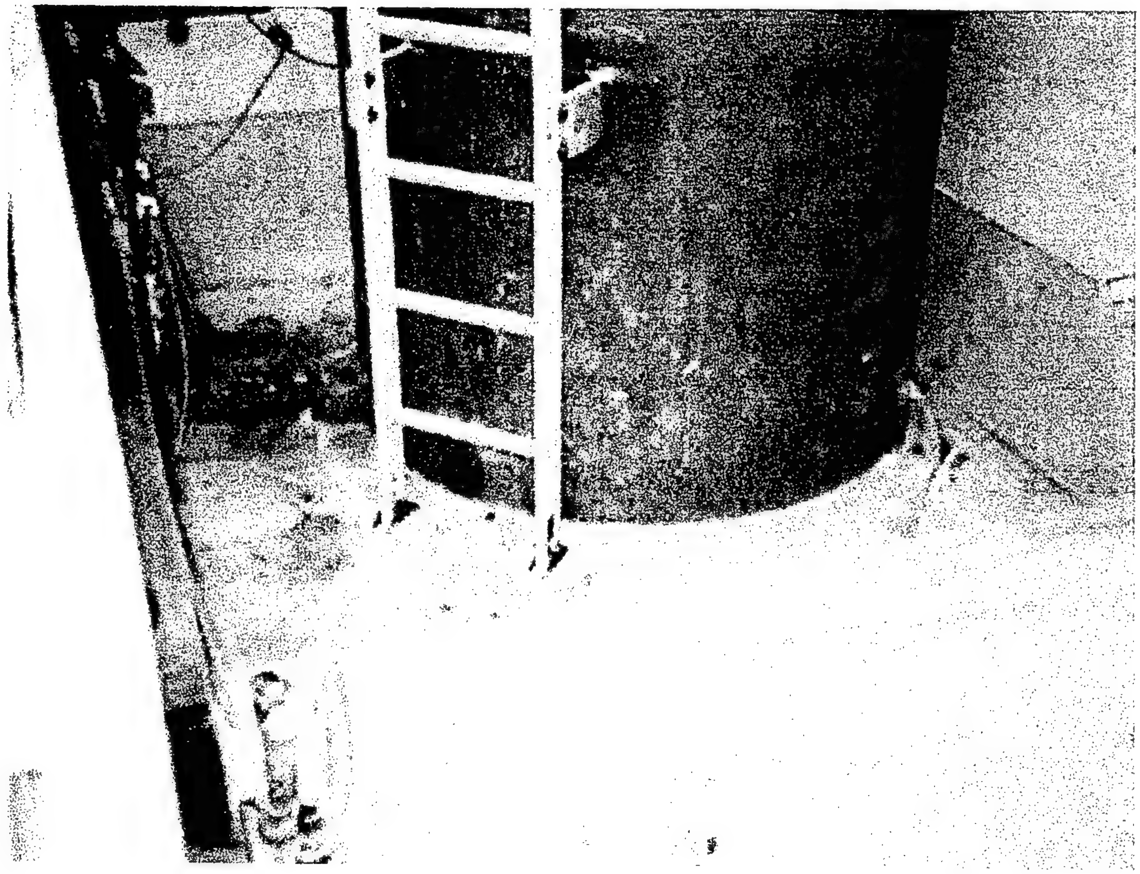


Figure 8: A 1,000 gallon tank of NaOH. Note the absorbent pads at base of the tank to adsorb NaOH spills. In the lower right forefront of the picture the foundation ring for a removed 1,000 gallon storage tank that contained HCl is pictured. Also note the ½" plastic line in the lower left foreground of the picture contains 90% sulfuric acid that is connected to the acid pump. The sulfuric acid tank depicted in Figure 9 is outside the wall in the immediate background.

Figures 8 and 9 depict an impractical component of the IWTP design and a serious potential safety hazard. The design for the IWTP chemical storage tanks utilized a common chemical storeroom and concrete spill retention wall. The chemical tanks stored NaOH and HCl, two highly reactive chemicals. No level detection equipment was installed on the tanks and numerous spills and leaks have occurred. The HCl tank has been removed, but an acid pump is within the retention wall and charged with H_2SO_4 from a temporary acid tank. If NaOH and H_2SO_4 contact within the chemical store room dangerous amounts of heat and H_2S would be released. This problem must be addressed before use of the IWTP again.

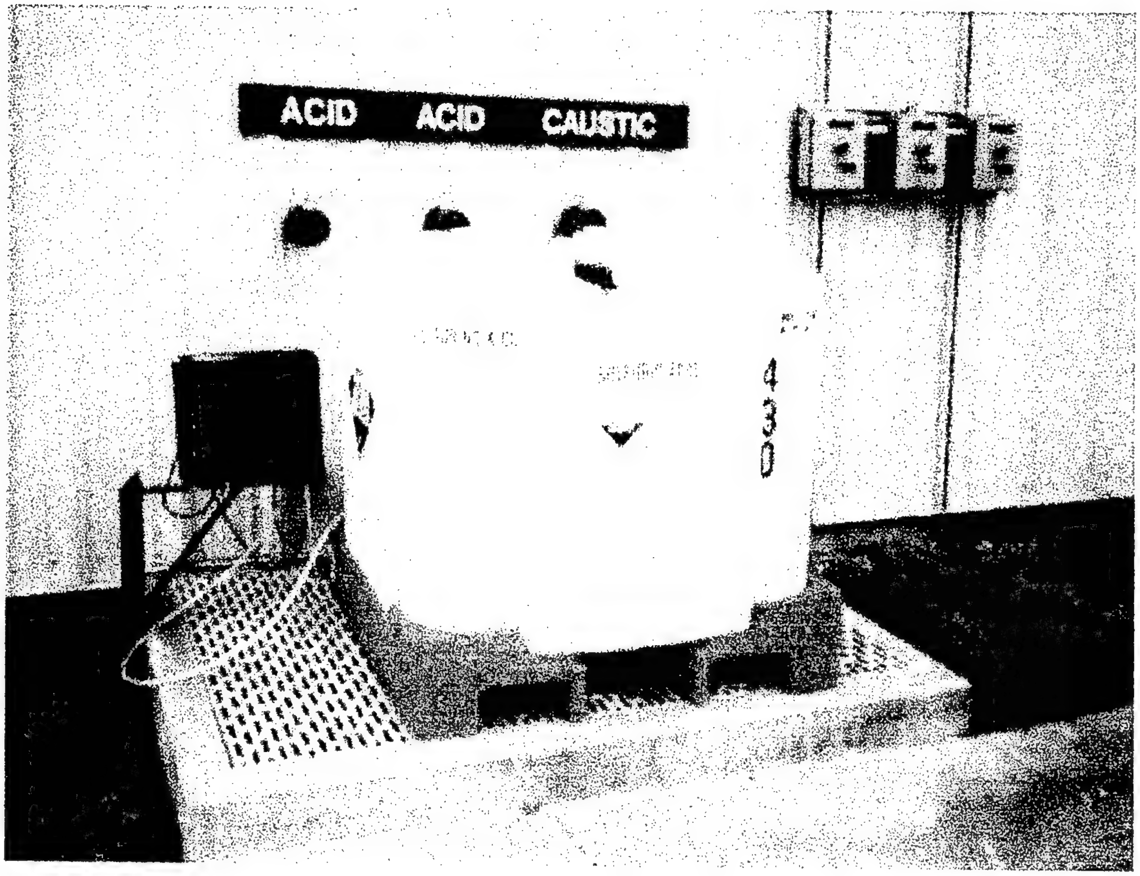


Figure 9: Approximately 500 gallons of 90% sulfuric acid for pH adjustment prior to the DAF was stored outside the IWTP building over a grated drain that would return flow to the IWTP influent equalization basin. On the inside wall of the building, immediately adjacent to acid tank is a 1,000 gallon tank containing NaOH. Access to this acid storage tank is not secure.

SECTION 3

INDUSTRIAL WASTEWATER SYSTEM ANALYSIS

This report section presents and discusses industrial wastewater problems at Whiteman AFB that are systematic in nature. It describes and explains linkage between sources generating industrial wastewater, the treatment capabilities and permit requirements of the FOTW, and the industrial wastewater treatment plant operations. This section of the report identifies conclusions drawn by the authors from all available information concerning industrial waste sources, the FOTW, and the IWTP operations and it also identifies conclusions that cannot be drawn at this time. Additional information requirements needed to develop complete recommendations concerning operation of the Whiteman AFB industrial wastewater system are also presented. This information is organized by the primary industrial wastewater system components: 1) industrial wastewater, 2) the IWTP, and 3) the FOTW.

3.1 Industrial Wastewater

Industrial wastewater generated from fifty-one industrial shops and base operations are collected by four industrial sewer legs and trunk lines that drain to a wet well and lift station at the AFFF surge tank. Industrial wastes flowing to the AFFF wet well are either pumped to the IWTP equalization basin, the AFFF surge tank, or diverted to the sanitary wastewater collection system where the wastewaters are delivered to the FOTW and treated. Only three of the fifty-two industrial shops were reviewed by the AL/OEBW Field Team during the site visit. Table 7 identifies all of the known industrial wastewater generating activities that occur at Whiteman AFB. Each industrial function identified in Table 7 is associated with a building location number that can be located on Figure 10.

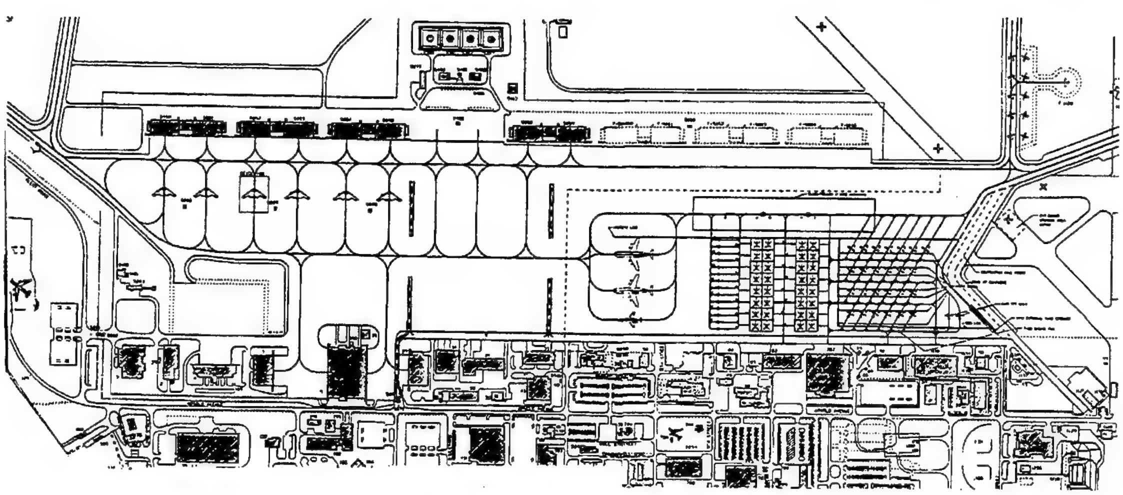


Figure 10: Building and Industrial Functions

Table 7: Industrial Wastewater Function and Building Number			
Building #	**Function**	**Building #**	**Function**
1	B-2 Fuel Cell Hanger	2	B-2 Engine Maintenance
4	AGE and BRA Storage	7	AGE
9	B-2 Maintenance Hanger	14	B-2 Weapons Load Trainer
19	Hangar 9 Storage	27	B-2 Corrosion Control Hangar
33	393rd. Bomb Squadron	34	Fire Station
35	Base Operations	36	Generator/Equipment Building
44	Army National Guard (ANG) Administration	50	Control Tower
52	ANG Maintenance	69	TE Load Test Facility
90	Petroleum Operations	91	T-38 Maintenance Hangar
190	Hangar 9 Break Patio	1117	A-10 Maintenance Hangar
1118	A-10 Special Purpose Hangar	`1119	A-10 Composite Maintenance
1125	Refueler Vehicle Maintenance	5050	B-2 Maintenance Dock # 1
5051	B-2 Maintenance Dock # 2	5052	B-2 Maintenance Dock # 3
5053	B-2 Maintenance Dock # 4	5054	B-2 Maintenance Dock # 5
5055	B-2 Maintenance Dock # 6	5058	B-2 Maintenance Dock # 7
5059	B-2 Maintenance Dock # 8	5060	B-2 Maintenance Dock # 9
5061	B-2 Maintenance Dock # 10	5062	B-2 Maintenance Dock # 11 (FY 97)
5063	B-2 Maintenance Dock # 12 FY 97)	5064	B-2 Maintenance Dock # 13 (FY 99)
5065	B-2 Maintenance Dock # 14 (FY99)	5068	Hydrant CASS Systems
5069	Hydrant CASS Systems	5070	Hydrant CASS Systems
5070	CASS Maintenance Shop	5300	Fuel Tank
5301	Fuel Tank	5302	Fuel Tank
5303	Fuel Tank	5400	Fuel Pump House
5401	Fuel Pump Control house	5402	Fuel Pump house
5403	Hydrant CASS Systems	5413	AFFF Storage Tank
5415	Industrial Wastewater Treatment Plant		

Each of the other industrial shops may have a significant or unexpected impact on the character of industrial wastewater. It is essential that this impact is understood in order to optimize system operations for management of the Whiteman AFB industrial wastewaters. This is especially true of those industrial shops or flight line operations that will generate AFFF wastes as a result of hydrant testing and fire protection. Both the present and future character of wastewater generated from all of the shops and operations identified in Table 7 must be established to build a foundation for properly managing the industrial wastewater problems at Whiteman AFB.

Self reporting data of the influent to the IWTP was also reviewed as an element of this operation analysis. The 1995 and 1996 historical IWTP influent data provides some insight to the character and dynamics of industrial wastewater character. The data is tabulated in Table 8.

Table 8: Characteristics of 1995 and 1996 IWTP Influent

Date	Total, CN Mg/l	Oil/Grease Mg/l	Phenol Mg/l	Purge. Organic Carbon Mg/l	Metals* Mg/l
8 March 95	ND	-	0.1	-	0.12
12 April 95	ND	15.0	ND	-	0.035
6 Sept. 95	ND	65.0	0.02	-	0.1
6 Oct. 95	ND	-	0.04	-	0.04
15 Nov. 95	ND	ND	12.0	-	0.05
6 Dec. 95	ND	13.0	2.46	110.0	0.03
4 January 96	ND	2.0	0.011	73.0	ND
30 January 96	ND	1.0	ND	82.0	ND
6 March 96	ND	13.0	0.127	190.0	.03
4 April 96	ND	7.0	0.017	108.0	0.011
3 May 96	ND	ND	0.005	43.0	ND
5 June 96	ND	17.0	0.047	145.0	0.098

ND not detected
- **not available**
- ***sum of metals analyzed**

Review of table 8 indicates that the average industrial wastewater character is not as strong as anticipated by the IWTP design team. However, the self reporting sample results are not sufficient to characterize the true character of the wastes to be treated at the IWTP. Future characterizations of industrial wastewater should address the following parameters: flow, pH, temperature, alkalinity, dissolved oxygen, conductivity, total dissolved solids, settleable solids, volatile suspended solids, total organic carbon, chemical oxygen demand, bio-chemical oxygen demand, total phosphate, ammonia, sulfides, oil and grease, total petroleum hydrocarbons, cyanide, heavy metals, volatile organic carbon and halogenated hydrocarbons. Any future industrial wastewater characterization study should also investigate possible changes of the hydraulic and organic character of the wastewater that may result from mission growth or elimination of infiltration/inflow.

In summary, until the system of industrial sources and character of industrial wastes and waste generating operations is accurately characterized with respect to variability and hydraulic/organic nature, industrial wastewater management problems will continue at Whiteman AFB. Operational upsets of the IWTP and/or FOTW, potential NPDES permit violations, concerns for worker safety, unexpected operation and maintenance expense and possible adverse publicity exposure may result.

3.2 Industrial Wastewater Treatment Plant

Operation of the IWTP on 12 December 1996 presented a unique opportunity to analyze the performance of both the IWTP units and the IWTP system. It cannot be determined whether or not the industrial wastewaters processed by the IWTP 12 December 1996 are representative of normal conditions. However, it is the belief of the AL/OEBW Field Team, and also some plant personnel, that the processed wastewater reflected the normal range of organic character imposed at the plant. Actual IWTP performance is presented in Table 9.

Table 9: IWTP Performance 12 December 1996

Time	BOD_5			COD			Oil/Grease			Heavy Metals		
	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%	In mg/l	Out mg/l	%
0 hour	180	31	83	170	1130	-564	83	88	-6	1.17	3.07	-162
2 hours	120	31	74	240	150	37	89	27	70	1.00	.29	71
4 hours	120	31	74	300	340	-13	64	88	-38	1.07	.21	80
Average	140	31	78	**237**	**540**	**-127**	**79**	**68**	**14**	**1.08**	**1.19**	**-10**

Data from Table 9 show the IWTP did not perform satisfactorily. Average sample data show that an increase of COD and heavy metals occurred from plant throughout. Also, average reduction of oil and grease was only 14 percent, and when analyzed with respect to time specific data the 14 percent performance efficiency is questionable. BOD_5 was reduced 78 percent by the IWTP system, however the IWTP was not designed to remove soluble BOD_5. The AL/OEBW Field Team concluded that the poor IWTP system performance on 12 December 1996 was a result of numerous causes. The most important issues negatively impacting IWTP system performance were:

- the influent contaminant characteristics are highly variable. The variability is due to both industrial process and chemistry changes as well as the failure of the equalization basin to normalize the wastewater,
- the average influent contaminant load on the IWTP, represents only a small fraction of the assumed design contaminant load,
- "short shift" or intermittent operation of the types of process units at the IWTP are not the most practical. Continuous operation of the IWTP system would be more conducive for improvement of performance,
- modification of the system's design operation (e.g., acid substitution for pH adjustment) decreased both unit and system performance,
- lack of "hands on" and classroom training for plant operators provided by the unit manufacturers or vendors,

- lack of operational control testing and equipment for all plant operations parameters (e.g., no conductivity meter, no Draeger tube test kit).

When the IWTP is viewed as a component of Whiteman AFB's industrial waste system its usefulness is questionable. Most, if not all, contaminants of concern appear to be effectively treated at the FOTW and routine operation of the IWTP does not provide additional surge capacity within the system to manage AFFF or petroleum spills. Nor does the IWTP currently provide any real protection or assurance that the FOTW will maintain compliance with the NPDES permit requirements.

3.3 Federal Owned Treatment Works

Most information related to the FOTW has been previously presented in Section 2. With respect to the FOTW's role in management system for industrial wastewater it should be viewed as the last line of defense. The principal systems operation problem posed to the FOTW is surges or slugs of oxygen-demanding wastes or slugs of oil and grease from petroleum spills. There are no treatment units at the FOTW that were designed to respond to slugs of toxic strong organic industrial wastes and petroleum spills. Those type industrial wastes can adversely impact the FOTW. The primary surge or slug treatment capabilities are located at the AFFF storage tank. Final characterization of the industrial wastewaters may indicate a need for secondary surge or slug treatment capabilities to be located at the headworks to the FOTW. Additionally, the average organic load on the FOTW is 760 pounds BOD_5 per day. This is significantly less loading than plant design and increases the FOTW's vulnerability to a serious surge of organics from industrial waste. If the plant was operating nearer the design load capacity of 3,150 pounds BOD_5 per day, it would be more capable to operationally respond to surges of organic loading from industrial wastewater.

3.4 Other Industrial Wastewater System Issues

Other issues also impact the industrial wastewater system. These issues are identified below:

- Maximum AFFF hydraulic surge and total capacity of AFFF storage within the system are not well defined.

- Ventilation of the IWTP building may be inadequate.

- Effect of infiltration/inflow upon industrial waste character is unknown and may significantly impact industrial wastewater character.

SECTION 4

CONCLUSIONS and RECOMMENDATIONS

4.1 Conclusions

The Whiteman AFB industrial wastewater system is a complex network of dynamic problems. Many of these problems are related and interdependent (e.g., H_2S corrosion), but some problems are completely independent (e.g., galvanic corrosion). Many of the Whiteman AFB industrial wastewater system problems are directly related to the changing mission at the base. The principal base mission, the B-2 bomber squadron, is currently growing and its flight support operations are still evolving. The principal issues and findings that have driven the IWS problems to date are:

- The wastewater characterization design assumptions that guided the design and development of the Whiteman IWS and IWTP do not reflect a representative picture of the current conditions and may not reflect a representative picture of future conditions.

- With respect to traditional industrial wastewater generated from flight operations, the processes and operations generating industrial wastewater at Whiteman AFB have changed significantly with respect to both their hydraulic and organic characteristics. It is suspected that significant changes of the industrial wastewater characteristics will continue until the flight operations and mission stabilizes.

- Some "as built" elements of the IWTP have characteristics that are impractical (e.g., chemical storage facilities, DAF system for removal of oil/grease with AFFF).

- Observations made at three industrial shops, analytical data characterizing the raw IWTP influent collected 12 December 1996, and the review of available IWTP influent records indicate that the IWTP is over-designed with respect to influent contaminant concentrations and plant loading.

- The IWTP requires sophisticated operation and maintenance. Additional operator training is required for the staff and additional control test capabilities are needed to achieve the IWTP design effluent treatment objectives.

- Hydrogen sulfide gas is generated within the IWS at concentrations that may be lethal or harmful to exposed persons. Concentrations of H_2S ranging from 5 to 10 ppm were measured within the IWTP building on 12 December 1996. Concentrations > 50 ppm were measured at the entrance manway to the influent lift station.

- NPDES permit violations and notice of violations may occur due to the industrial wastes generated at Whiteman AFB.

4.2 Recommendations

Based on information observed and developed during the AL/OEBW December 1996 site visit, and documents reviewed since the initial visit, an aggressive course of action is recommended to adequately characterize the IWS problems and initiate measures to correct any problems associated with the Whiteman AFB IWTP and FOTW NPDES permit compliance. Specific recommended elements are:

- An industrial pretreatment survey and industrial wastewater characterization assessment should be performed. Based on the results and analysis of these studies a conceptual design for treatment of industrial wastewater should be developed and recommended.

- An infiltration/inflow study currently contracted for Whiteman AFB should be expedited. Estimates of dilution to industrial wastewater strength should be developed from the infiltration/inflow study so future changes in industrial wastewater character can be anticipated.

- The IWTP should not be operated until impracticalities at the chemical storage facilities are corrected.

- The Air Force should notify the Missouri Department of Natural Resources of the status of its IWTP operations immediately.

- The IWTP DAF unit should not be operated as an element of the IWTP.

- HazWOPER training and OSHA required medical monitoring should be provided to IWTP personnel.

- The IWTP equalization unit should be operated as a surge tank unless industrial waste flows are > 100,000 gpd.

- After characterization of the industrial wastewater and completion of the industrial pretreatment survey, recommendations concerning: 1) adequacy of the industrial wastewater surge facilities, 2) continued operation or modification of the IWTP, and 3) management, communications, and coordination guidance integrating wastewater treatment management with base operations should be developed.

- Additional operator training and performance monitoring equipment should be provided to IWTP personnel if the plant is operated again.

SECTION 5

LIST OF REVIEWED INFORMATION and REFERENCES

Sverdrup Corporation, *"B-2 Support Facility, Package 56-A Industrial Wastewater Treatment Plant Facility Design"*, US Army Corps of Engineers, September 1992.

Sverdrup Corporation, *Whiteman AFB Sanitary Sewer Pretreatment Study-Phase I and II,* US Army Corps of Engineers, May 1995.

State of Missouri, Department of Natural Resources, *Whiteman AFB NPDES Permit # Mo.0029378.*

ACS Environmental, *Operations and Maintenance Manual ACS 220/60/SB Clarifier*; Baumgartner General Contractors, March 1993.

Westech Engineering, Inc., *Instruction Manual for 4316C Thickener;* June 1993.

Vulcan Industries, Inc., *Installation, Operation and Maintenance Manual-Sand Filters,* Baumgartner General Contractors, February 1994.

Vulcan Industries, Inc., *Installation, Operation and Maintenance Manual-Activated Carbon Filters,* Baumgartner General Contractors, February 1994.

Lee Mathews Equipment, Inc., *Operations and Maintenance Manuals for Guide-Mounted Sewage Lift Station Pumps;* Baumgartner General Contractors, February 1994.

Whiteman AFB, Missouri, *FOTW Self Reporting Records for 1995 and 1996.*

Whiteman AFB, Missouri, *Industrial Wastewater Treatment Plant Influent/Effluent Laboratory Analytical Results for 1995 and 1996.*

Whiteman AFB, Missouri, *IWTP Operators Log,* Darrel Taggert, 1995-96

APPENDIX 1

13 December 1996 Whiteman AFB, Missouri
Industrial Wastewater System Assessment
Out Briefing Outline

12/13/96

Whiteman AFB, Missouri
Industrial Wastewater System Assessment
Out Briefing Outline

1.0 Participants/Introduction

2.0 Project purpose: Review Whiteman AFB industrial wastewater system, identify problems and alternatives, and develop a plan to address issues of significance.

3.0 Expectations: Review process is continuing and initial evaluation has established a direction to the process that will enable successful industrial wastewater management system.

4.0 Initial Findings:

- **Industrial wastewater is a system of dynamic problems. Historical source of many issues is related to Whiteman AFB expanding and changing mission.**
- **Design assumptions for wastewater characterization not representative of current industrial waste streams.**
- **Processes generating industrial wastewater have significantly changed and are still changing.**
- **Range of hydraulic/organic wastewater characteristics is very broad and subject to rapid change.**
- **Some industrial wastewater treatment plant (IWTP) design characteristics are impractical (e.g., volume indicator NaOH tank, chemical storage tank layout, simplicity of operation).**
- **IWTP requires sophisticated operation and management. Upgrade needed for operator training and analytical/operational control testing.**
- **Conceptual industrial wastewater system design review and industrial wastewater treatment characterization is needed.**
- **NPDES Permit violations and Notice of Violations are possible.**
- **Health/safety concerns related to IWTP have been identified.**

5.0 "Get Well" Plan

- **Initiate industrial wastewater pretreatment survey.**
- **Initiate wastewater characterization/treatment study.**
- **Initiate conceptual wastewater treatment system design and alternatives review.**
- **Initiate corrective action.**

APPENDIX 2

NPDES PERMIT MO-0029378

STATE OF MISSOURI

DEPARTMENT OF NATURAL RESOURCES

MISSOURI CLEAN WATER COMMISSION

MISSOURI STATE OPERATING PERMIT

In compliance with the Missouri Clean Water Law, (Chapter 644 R.S. Mo. as amended, hereinafter, the Law), and the Federal Water Pollution Control Act (Public Law 92-500, 92nd Congress) as amended.

Permit No. MO-0029378

Owner: U.S. Air Force (USAF)

Owner's Address: 800 CSG/CC Whiteman Air Force Base, MO 65305-5000

Operating Authority: N/A

Operating Authority's Address: N/A

Facility Name: USAF, Whiteman Air Force Base

Facility Address: 800 CSG/CC Whiteman Air Force Base, MO 65305-5000

Legal Description: SE¼, SE¼, Sec. 32, T46N, R24W, Johnson County

Receiving Stream & Basin: Brewer Branch (Blackwater River Basin) (10300104-23-01) (U)

is authorized to discharge from the facility described herein, in accordance with the effluent limitations and monitoring requirements as set forth herein:

FACILITY DESCRIPTION

Outfall #001 - Air Force Base (Federal Facility) - SIC #4952
Trickling filter/anaerobic digestion/sludge is disposed of by land application and/or landfilling.
Design population equivalent is 13,300.
Average Design flow is 1.26 million gallons per day.
Peak design flow is 2.19 million gallons per day.
Actual flow is 0.5 million gallons per day.
Design sludge production is 180 dry tons/year.

(continued on next page)

This permit authorizes only wastewater discharges under the Missouri Clean Water Law and the National Pollutant Discharge Elimination System; it does not apply to other regulated areas. This permit may be appealed in accordance with Section 644.051.6 of the Law.

Effective Date

John A. Young
John A. Young
Director, Division of Environmental Quality

Expiration Date

Director of Staff, Clean Water Commission

MO 780-0041 (10-93)

Recycled Paper

FACILITY DESCRIPTION (continued)

Outfall #002 - Instream (Downstream) compliance point just below confluence of Brewer Branch with Clear Creek.

Outfall #003 - Instream (Upstream) monitoring point just above confluence of Brewer Branch with Clear Creek.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

PAGE NUMBER 3 of 12

PERMIT NUMBER MO-0029378

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The interim effluent limitations shall become effective upon issuance and remain in effect until May 31, 1997. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	INTERIM EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #001						
Flow	MGD	*		*	once/weekday**	24 hr. total
Biochemical Oxygen Demand	mg/L	45		30	once/week	24 hr. comp.
Chemical Oxygen Demand	mg/L					
May 1 - Oct. 31 (Summer)		90		60	once/week	24 hr. comp.
Nov. 1 - Apr. 30 (Winter)		120		90	once/week	24 hr. comp.
Total Suspended Solids	mg/L	45		30	once/week	24 hr. comp.
Oil and Grease	mg/L	20		15	once/week	grab
pH - Units	SU	***		***	once/week	grab
Temperature	F	****		****	once/week	grab
Copper, Total Recoverable	ug/L	43		43	once/month	grab
Lead, Total Recoverable	ug/L	20		20	once/month	grab
Zinc, Total Recoverable	ug/L	150		150	once/month	grab
Cyanide, Amenable to Chlorination	ug/L	22		22	once/month	grab
Phenol, Total	ug/L	100		100	once/month	grab
Silver, Total Recoverable (continued on next page)	ug/L	8.2		8.2	once/month	grab

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE ________ THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Parts I & III STANDARD CONDITIONS DATED October 1, 1980 & August 15, 1994, AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

MO 780-0010 (8-91)

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS	PAGE NUMBER 4 of 12
	PERMIT NUMBER MO 0029378

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The interim effluent limitations shall become effective upon issuance and remain in effect until May 31, 1997. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	INTERIM EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #001 (continued)						
Ammonia as N	ug/L	*		*	once/month	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY. THE FIRST REPORT IS DUE ______						
Total Toxic Organics (Note 1)	mg/L	*		*	once/year in April	grab
Whole Effluent Toxicity (WET) Test	% Survival	(See Special Conditions)			once/year in April	24 hr. composite
MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY; THE FIRST REPORT IS DUE ______ THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.						

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Parts I & III STANDARD CONDITIONS DATED October 1,1980 & August 15, 1994 AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

MO 780-0010 (8/91)

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

PERMIT NUMBER MO-0029378

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The final effluent limitations shall become effective June 1, 1997 and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #001						
Flow	MGD	*		*	once/weekday**	24 hr. total
Biochemical Oxygen Demand	mg/L				once/week	24 hr. comp.
June 1 - Sept. 30			15	10		
Oct. 1 - May 31			20	15		
Chemical Oxygen Demand	mg/L				once/week	24 hr. comp.
June 1 - Sept. 30		90		60		
Oct. 1 - May 31		120		90		
Total Suspended Solids	mg/L		20	15	once/week	24 hr. comp.
Oil and Grease	mg/L	20		15	once/week	grab
pH - Units	SU	***		***	once/week	grab
Temperature	F	****		****	once/week	grab
Copper, Total Recoverable	ug/L	43		43	once/month	grab
Lead, Total Recoverable	ug/L	20		20	once/month	grab
Zinc, Total Recoverable	ug/L	150		150	once/month	grab
Cyanide, Amenable to Chlorination	ug/L	22		22	once/month	grab
Phenols, Total	ug/L	100		100	once/month	grab
Silver, Total Recoverable	ug/L	8.2		8.2	once/month	grab
(continued on next page)						

MONITORING REPORTS SHALL BE SUBMITTED MONTHLY; THE FIRST REPORT IS DUE ________________________

THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Parts I & III STANDARD CONDITIONS DATED October 1, 1980 and August 15, 1994, AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

MO 780-0010 (8/91)

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS	PAGE NUMBER 6 of 12
	PERMIT NUMBER MO 0029378

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The final effluent limitations shall become effective June 1, 1997 and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #001						
Ammonia as N June 1 - Sept. 30 Oct. 1 - May 31	mg/L	3 4.5		2 3.5	once/month	grab
MONITORING REPORTS SHALL BE SUBMITTED MONTHLY, THE FIRST REPORT IS DUE ______						
Total Toxic Organics (Note 1)	mg/L	*		*	once/year in April	grab
Whole Effluent Toxicity (WET) Tests	% Survival	(See Special Conditions)			once/year in April	24 hr. comp.

MONITORING REPORTS SHALL BE SUBMITTED ANNUALLY; THE FIRST REPORT IS DUE ______.
THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Parts I & III STANDARD CONDITIONS DATED October 1, 1980 and August 15, 1994, AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

MO 780-0010 (6/93)

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS	PAGE NUMBER 7 of 12 PERMIT NUMBER MO-0029378

The permittee is authorized to discharge from outfall(s) with serial number(s) as specified in the application for this permit. The final effluent limitations shall become effective upon issuance and remain in effect until expiration of the permit. Such discharges shall be controlled, limited and monitored by the permittee as specified below:

OUTFALL NUMBER AND EFFLUENT PARAMETER(S)	UNITS	FINAL EFFLUENT LIMITATIONS			MONITORING REQUIREMENTS	
		DAILY MAXIMUM	WEEKLY AVERAGE	MONTHLY AVERAGE	MEASUREMENT FREQUENCY	SAMPLE TYPE
Outfall #002 - instream (downstream) compliance point						
Cyanide (Amenable to Chlorination)	mg/L	5		5	once/quarter*****	grab
pH - Units	SU	***		***	once/quarter*****	grab
Outfall #003 - instream (upstream) monitoring point						
Cyanide (Amenable to Chlorination)	mg/L	*		*	once/quarter*****	grab
pH - Units	SU	***		***	once/quarter*****	grab

MONITORING REPORTS SHALL BE SUBMITTED QUARTERLY; THE FIRST REPORT IS DUE __________
THERE SHALL BE NO DISCHARGE OF FLOATING SOLIDS OR VISIBLE FOAM IN OTHER THAN TRACE AMOUNTS.

B. STANDARD CONDITIONS

IN ADDITION TO SPECIFIED CONDITIONS STATED HEREIN, THIS PERMIT IS SUBJECT TO THE ATTACHED Parts I & III STANDARD CONDITIONS DATED October 1, 1980 and August 15, 1994, AND HEREBY INCORPORATED AS THOUGH FULLY SET FORTH HEREIN.

MO 780 0010 (8/91)

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (continued)

* Monitoring requirement only.

** Once each weekday means: Monday, Tuesday, Wednesday, Thursday and Friday.

*** pH is measured in pH units and is not to be averaged. The pH is limited to the range of 6.0-9.0

**** Effluent shall not elevate or depress the temperature of the receiving stream beyond the mixing zone more than five (5)F. The stream temperature beyond the mixing zone shall not exceed ninety (90)F due to the effluent.

***** Once per quarter in the months of January, April, July and October.

A. Effluent Limitations and Monitoring Requirements (continued)

Note 1.

Acenaphthene
Acrolein
Acrylonitrile
Benzene
Benzidine
Carbon Tetrachloride (tetrachloromethane)
Chlorobenzene
1,2,4-trichlorobenzene
Hexachlorobenzene
1,2-dichloroethane
1,1,1 trichloroethane
Hexachloroethane
1,1-dichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
Chloroethane
Bis (2-chloroethyl) ether
2-chloroethyl vinyl ether
N-nitrosodi-n-propylamine
Pentachlorophenol
Phenol
Bis (2-ethylhexyl) phthalate
Butyl benzyl phthalate

Di-n-butyl phthalate

Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
1,2-benzanthracene (benzo(a)anthracene)
Benzo(a)pyrene (3,4-benzopyrene)
3,4-benzofluoranthene (benzo(b)fluoranthene)
11,12-benzofluoranthene (benzo(k)fluoranthene)
Chrysene
Anthracene
1,12-benzoperylene (benzo(ghi)perylene)
Fluorene
2-chloronaphthalene
2,4,6-trichlorophenol
Parachlorometa cresol
Chloroform (trichloromethane)
2-chlorophenol
1,2-dichlorobenzene
1,3-dichlorobenzene

1,4-dichorobenzene
3,3-dichlorobenzidine
1,1-dichloroethylene
1,2-trans-dichloroethylene
2,4-dichlorophenol
1,2-dichloropropane (1,3-dichloropropane)
2,4-dimethylphenol
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2-diphenylhydrazine
Ethylbenzene
Fluoranthene

4-chlorophenyl phenyl ether
4-bromophenyl phenyl ether
Bis (2-chloroisopropyl) ether
Bis (2-chloroethoxy) methane
Methylene Chloride (dichloromethane)
Methyl Chloride (chloromethane)
Methyl bromide (bromomethane)
Bromoform (tribromomethane)
Dichlorobromomethane
Chlorodibromemethane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Naphthalene
Nitrobenzene
2-nitrophenol
4-nitrophenol
2,4-dinitrophenol
4,6-dintro-o-cresol
N-nitrosodimethylamine
N-nitrosodiphenylamine
Phenanthrene
1,2,5,6-dibenzanthracene
(dibenzo(a,h)anthracene)
Indeno (1,2,3-cd) pyrene
(2,3-o-phenylene pyrene)
Pyrene
Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl Chloride (chloroethylene)
Aldrin
Dieldrin
Chlordane (technical mixture and metabolites)
4,4-DDT
4,4-DDE (p,p-DDX)
4,4-DDD (p,p-TDE)
Alpha-endosulfan
Beta-endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide (BHC
hexachlorocyclohexane)
Alpha-BHC
Beta-BHC
Gamma-BHC
Delta-BHC (PCB polychlorinated biphenyls)
PCB-1242 (Arochlor 1242)
PCB-1254 (Arochlor 1254)
PCB-1221 (Arochlor 1221)
PCB-1232 (Arochlor 1232)
PCB-1248 (Arochlor 1248)
PCB-1260 (Arochlor 1260)
PCB-1016 (Arochlor 1016)
Toxaphene

C. SPECIAL CONDITIONS

1. This permit may be reopened to establish revised effluent limitations and monitoring requirements based on the results of toxicity testing, instream monitoring and/or effluent monitoring results which indicate that water quality standards have been exceeded.

2. Sludge and Biosolids Use For Domestic Wastewater Treatment Facilities

   a. Permittee shall comply with the pollutant limitations, monitoring, reporting, and other requirements in accordance with the attached permit Standard Conditions.

3. The Best Management Practices (BMP) plan submitted to the Department and approved to prevent or minimize the potential for release of significant amounts of toxic or hazardous pollutants to the waters of the state through plant site runoff shall be implemented Any revisions to the BMP shall be approved by the Department prior to implementation.

4. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted practices shall be selected and used to insure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements are consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10% from true discharge rates throughout the range of expected discharge volumes.

5. Changes in Discharges of Toxic Substances

The permittee shall notify the Director as soon as it knows or has reason to believe:

a. That any activity has occurred or will occur which would result in the discharge of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"
   (1) One hundred micrograms per liter (100 ug/L);
   (2) Two hundred micrograms per liter (200 ug/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 ug/L) for 2,5 dinitrophenol and for 2-methyl 4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
   (3) Five (5) times the maximum concentration value reported for the pollutant in the permit application;
   (4) The level established in Part A of the permit by the Director.

b. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

6. All pesticide use at the base shall be fully documented. An annual report summarizing pesticide use shall be submitted by January 31 of each year. The report shall include type and amount of pesticides used, locations, methods of application and include any analysis conducted for pesticides.

C. SPECIAL CONDITIONS (continued)

7 Whole Effluent Toxicity (WET) tests will be conducted as follows:

SUMMARY OF WET TESTING FOR THIS PERMIT				
OUTFALL	A.E.C. %	FREQUENCY	SAMPLE TYPE	MONTH
Interim 001	100	once/year	24 hour comp.	April
Final 001	100	once/year	24 hour comp.	April

a. Test Schedule and Follow-Up Requirements

(1) Perform a single-dilution test in the months and at the frequency specified above.

If the test passes the effluent limit do not repeat test until the next test period. Submit results with the annual report.

If the test fails the effluent limit a multiple dilution test shall be performed within 30 days, and biweekly thereafter until one of the following conditions are met:

(a) THREE CONSECUTIVE MULTIPLE-DILUTION TESTS PASS. No further tests need to be performed until next regularly scheduled test period.

(b) A TOTAL OF THREE MULTIPLE-DILUTION TESTS FAIL.

(2) The permittee shall submit a summary of all test results for the test series to the Planning Section of the WPCP, DNR, Box 176, Jefferson City, MO within 14 days of the third failed test. DNR will contact the permittee with initial guidance on conducting a toxicity identification evaluation (TIE) or toxicity reduction evaluation (TRE). The permittee shall submit a plan for conducting a TIE or TRE to the Planning Section of the WPCP within 60 days of the date of DNR's letter. This plan must be approved by DNR before the TIE or TRE is begun. A schedule for completing the TIE or TRE shall be established in the plan approval.

(3) Upon DNR's approval, the TIE/TRE schedule may be modified if toxicity is intermittent during the TIE/TRE investigations. A revised WET test schedule may be established by DNR for this period.

(4) If a previously completed TIE has clearly identified the cause of toxicity, additional TIEs will not be required as long as effluent characteristics remain essentially unchanged and the permittee is proceeding according to a DNR approved schedule to complete a TRE and reduce toxicity. Regularly scheduled WET testing as required in part b.(1) will be required during this period.

(5) In addition to the WET test summary report required in part (2), all failing test results shall be reported to DNR within 14 days of the availability of results.

(6) All WET test results for the reporting period shall be summarized and submitted to DNR by the end of the following October. When WET test sampling is required to run over one DMR period, each DMR report shall contain information generated during the reporting period.

C. SPECIAL CONDITIONS (continued)

7. Whole Effluent Toxicity (WET) test (continued)

b. PASS/FAIL procedure and effluent limitations

(1) To pass a single-dilution test, mortality observed in the AEC test concentration shall not be significantly different (at the 95% confidence level; p = 0.05) than that observed in the upstream receiving-water control. The appropriate statistical tests of significance will be those outlined in the most current USEPA acute toxicity manual or those specified by the MDNR.

(2) To pass a multiple-dilution test:

(a) the computed percent effluent at the edge of the zone of initial dilution (AEC) must be less than three-tenths (0.3) of the LC concentration for the most sensitive of the test organisms; or,

(b) all dilutions equal to or greater than the AEC must be nontoxic. Failure of one multiple-dilution test is considered an effluent limit violation.

c. Test Conditions

(1) Test species: Ceriodaphnia dubia and fathead minnows, Pimephales promelas. Organisms used in WET testing should come from cultures reared for the purpose of conducting toxicity tests and should be cultured in a manner consistent with the most current USEPA guidelines. All test animals should be cultured as described in EPA-600/4-90/027.

(2) Test period: 48 hours at the "Acceptable Effluent Concentration" (AEC) specified above.

(3) When dilutions are required, upstream receiving stream water will be used as dilution water. If upstream water is unavailable or if mortality in the upstream water exceeds 10%, "reconstituted" water will be used. Procedures for generating reconstituted water will be supplied by the Department of Natural Resources (DNR).

(4) Tests should be initiated immediately after the sample is collected, but tests must be initiated no later than 36 hours after collection.

(5) Single-dilution tests will be run with:

(a) Effluent at the AEC concentration;
(b) 100% receiving-stream water (if available), collected upstream of the outfall at a point beyond any influence of the effluent; and
(c) reconstituted water

(6) Multiple-dilution tests will be run with:

(a) 100%, 50%, 25%, 12.5%, and 6.25% effluent, unless the AEC is less than 25% effluent, in which case dilutions will be 4 times the AEC, two times the AEC, AEC, 1/2 AEC and 1/4 AEC.
(b) 100% receiving-stream water (if available), collected upstream of the outfall at a point beyond any influence of the effluent; and
(c) reconstituted water.

(7) If reconstituted-water control mortality for a test species exceeds 10%, the entire test will be rerun.

C. SPECIAL CONDITIONS (continued)

8. The bypass structure leading from the junction box which follows the primary clarifiers and leads to the outfall shall be plugged upon completion of the improvements covered under this permit.

9. Report as no-discharge when a discharge does not occur during the report period.

10. This permit may be modified, or alternatively revoked and reissued, to comply with any applicable effluent standard or limitation issued or approved under Sections 301(b)(2)(C), and (D), 304(b)(2) and 307(a)(2) of the Clean Water Act, if the effluent standard or limitation so issued or approved:

(a) Contains different conditions or is otherwise more stringent than any effluent limitation in the permit; or
(b) Controls any pollutant not limited in the permit.

The permit as modified or reissued under this paragraph shall also contain any other requirements of the Act then applicable.

11. General Criteria. The following water quality criteria shall be applicable to all waters of the state at all times including mixing zones. No water contaminant, by itself or in combination with other substances, shall prevent the waters of the state from meeting the following conditions:

(a) Waters shall be free from substances in sufficient amounts to cause the formation of putrescent, unsightly or harmful bottom deposits or prevent full maintenance of beneficial uses;

(b) Waters shall be free from oil, scum and floating debris in sufficient amounts to be unsightly or prevent full maintenance of beneficial uses;

(c) Waters shall be free from substances in sufficient amounts to cause unsightly color or turbidity, offensive odor or prevent full maintenance of beneficial uses;

(d) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life;

(e) There shall be no significant human health hazard from incidental contact with the water;

(f) There shall be no acute toxicity to livestock or wildlife watering;

(g) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community;

(h) Waters shall be free from used tires, car bodies, appliances, demolition debris, used vehicles or equipment and solid waste as defined in Missouri's Solid Waste Law, section 260.200, RSMo, except as the use of such materials is specifically permitted pursuant to section 260.200-260.247.

12. Outfalls must be marked in field.

Date of Fact Sheet: October 10, 1996

Date of Public Notice: October 18, 1996

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT FACT SHEET

This Fact Sheet explains the applicable regulations, rationale for development of this permit and the public participation process.

NPDES PERMIT NUMBER: MO-0029378

FACILITY NAME: Whiteman Air Force Base

OWNER NAME: U.S. Air Force

LOCATION: Sec. 32 T46N R24W County: Johnson

RECEIVING STREAM: Brewer Branch (Blackwater River Basin)(10300104-23-01)

FACILITY CONTACT PERSON: Edward K. Lenz TELEPHONE: (816) 687-6218

FACILITY DESCRIPTION AND RATIONALE

The Whiteman Air Force Base wastewater treatment facility is a trickling filter system with primary and secondary settling. The design population equivalent is 13,300 and the design flow is 1.26 million gallons per day. The average actual flow is 500,000 gallons per day. Sludge is treated in anaerobic digesters before being disposed of by land application or removal to a landfill. The design sludge production is 180 dry tons per year. The actual sludge production is approximately 70 dry tons per year.

The limits for this facility were based on the effluent regulations and water quality standards in 10 CSR 20-7 (water quality review sheet prepared by Planning Section is attached).

Interim limits are being proposed because Air Force Base is constructing a wetlands.

This permit will be issued for a period of five years.

October 18, 1996
PAGE Two

FACT SHEET
Whiteman Air Force Base
MO-0029378

PUBLIC PARTICIPATION

Public comments on the proposed permit are being requested in accordance with Public Participation regulation under 10 CSR 20 6.020

A copy of the public notice and this fact sheet are being forwarded to the applicant, the District Engineer of the U.S. Army Corps of Engineers, the U.S. Fish and Wildlife Service, the Environmental Protection Agency and the Missouri Department of Conservation. Other interested individuals may obtain a copy on request by writing to the address listed below for comment letters.

Comments should be confined to the issues relating to the proposed action and permit and their effect on water quality. The Missouri Department of Natural Resources may not consider comments or objections to a permit based on questions of zoning, location, or other non water quality issues. See, Curdt v. MO Clean Water Commission, 586 S.W. 2d 58 (Mo. App. 1979).

The proposed determinations of the draft permit are tentative pending the public notice process.

Persons wishing to comment upon or object to the proposed determinations are invited to submit them in writing to: Department of Natural Resources, Division of Environmental Quality, (Missouri Clean Water Commission), P.O. Box 176, Jefferson City, Missouri 65102, ATTN: Daniel R. Schuette, Chief of Permit Section. Please include the permit number of the draft permit in all comment letters.

Within 30 days from the public notice date, as listed on page one, all water quality comments received will be considered in the formulation of all final determinations regarding this application. If response to the public notice indicates significant public interest, a public hearing may be held after due notice. Public hearing and/or issuance of the NPDES permit will be processed according to 10 CSR 20-6.020.

Copies of all draft permits, comments and other information are available for inspection and copying at the Department of Natural Resources, Division of Environmental Quality, (Missouri Clean Water Commission) Water Pollution Control Program, P.O. Box 176, 205 Jefferson Street, Jefferson City, Missouri 65102.

PERMIT REGULATIONS

The Federal Water Pollution Control Act ("Clean Water Act" Section 402 Public Law 92-500 as amended) established the National Pollutant Discharge Elimination System (NPDES) permit program. This program regulates the discharge of pollutants from point sources into the waters of the United States. All such discharges are unlawful without a permit (Section 301 of the "Clean Water Act"). After a permit is obtained, a discharge not in compliance with all permit terms and conditions is unlawful. NPDES permits in Missouri are issued by the Director of the Department of Natural Resources under an approved NPDES program, operating in accordance with federal and state laws (Federal "Clean Water Act" and "Missouri Clean Water Law" Section 644 as amended).

WATER QUALITY STANDARDS

10 CSR 20-7.031 Missouri Water Quality Standards, Missouri Department of Natural Resources (the Department) "defines the Clean Water Commission's water quality objectives in terms of water uses to be maintained and the criteria to protect those uses".

EFFLUENT LIMITATIONS

In order to protect these beneficial uses and the water quality of surface waters and groundwater, effluent limitations are being established under federal and state laws. The monitoring requirements for all parameters have been established by the Department in compliance with 10 CSR 20 7.015 Effluent Regulation.

The current Department effluent regulations 10 CSR 20-7.015 states that non domestic waste discharges "shall meet the applicable control technology currently effective or that which will become effective during the life of the permit. Where this definition is not available or applicable the Department shall set specific parameter limitations using best engineering judgment as defined in 402(a)(1) of the Federal Clean Water Act".

STANDARD CONDITIONS

The standard conditions attached to the draft permit are applied to all NPDES permittees. They reflect requirements of federal (40 CFR 122) and state law (10 CSR 20-Chapter 6) with respect to NPDES permittee duties, responsibilities and liabilities.

Water Quality Review Sheet
Page Two

ANTIDEGRADATION CONSIDERATIONS: As a baseline, water quality necessary to protect designated uses shall be maintained. However, "When water quality exceeds level necessary to protect beneficial uses, that quality shall be fully maintained and protected" (from Water Quality Standards). Because Brewer Branch and Clear Fork flow through a state park, a stringent position regarding protection of aesthetics and aquatic life in both streams is required. A rather high-quality effluent is currently being discharged; a lower effluent quality would degrade the stream and violate the antidegradation provisions. Therefore, no lowering of water quality should be allowed

DESCRIPTION OF RECEIVING WATERS: Brewer Branch appears to have good gradient and velocity at the limited access points; it is reported to have sizeable pools also. There is normally no flow above the STP. Clear Fork is a prairie type, fairly low-gradient, turbid stream with limited riffles; it drains a mixture of forested land, cropland, and pasture. About one mile below the discharge, Brewer Branch enters Knob Noster State Park; Clear Fork flows through the park for about three miles below its confluence with Brewer Branch. Brewer Branch and Clear Fork are removed from the main development in the park, although an equestrian trail crosses and then follows the streams for some distance.

FACILITY INFORMATION: The STP is a trickling filter with a design PE of 10,000 and current limits of "30/30" for BOD and NFR, with limits for metals. DMRs for the past year indicate that BODs average about 20 mg/L, and recent warm-weather samples indicate BODs usually less than 15 mg/L. Effluent-ammonia data has been collected monthly since the beginning of 1991--levels have consistently been less than 1 mg/L.

OTHER POINT SOURCES: The city of Knob Noster discharges to Clear Fork about 4 miles below the entry of Brewer Branch. The Whiteman STP effluent is not expected to affect the stream in that area. Other discharges to Clear Fork are minor in nature.

NONPOINT SOURCES: Nutrients from agricultural sources contribute to algae production and turbidity in this type of stream. Livestock-watering use of this type stream is also common--livestock wastes directly entering the stream may contribute nutrient, solids, and oxygen-demanding material.

FIELD DATA:
----MDNR low-flow visual survey; limited dissolved--oxygen and ammonia data, 1987
----MDNR one-day CBOD and ammonia date, November 1990
----Air Force--several years of weekly dissolved-oxygen and BOD readings immediately above and below the STP, and ½ mile below the STP
----MDNR visual survey and limited dissolved-oxygen and ammonia data from Brewer Branch, June 1991
----MDNR low-flow, dissolved oxygen and NH3N data; July 1991

SUMMARY OF FIELD DATA AND MODEL DEVELOPMENT:

A summary of the receiving-stream data collected is attached; these data generally indicate acceptable in-stream water quality. An earlier survey indicated an impact on Brewer Branch (including the lower reach within the state park), but no impact on Clear Fork. AFB data ½ mile below the STP (and above the park) has indicated low warm-weather dissolved oxygen. No ammonia violations have been noted in Clear Fork. The July 1991 data was taken in hot, dry weather when adverse effects should be most evident, and yet the impacts on the stream were minimal, although one low dissolved-oxygen value and some excess algae were noted just below Brewer Branch.

WATER QUALITY REVIEW SHEET

NAME OF FACILITY: Whiteman Air Force Base

NPDES PERMIT NO: MO-0029378

RECEIVING STREAM: Tributary to Clear Fork (Brewer Branch); 1.5 miles to Clear Fork

RIVER REACH NO: 10300104-23-01

LEVEL OF ANALYSIS: Level III (QUAL 2E steady-state model)

STP DESIGN FLOW: 7Q10 low flow of "0" for both immediate tributary and Clear Fork

STREAM CLASSIFICATION: Brewer Branch is unclassified; Clear Fork is Class C (intermittent flow; permanent pools)

BENEFICIAL USES: Brewer Branch: no designated beneficial uses Clear Fork: livestock, wildlife watering; aquatic life protection (limited warm-water fishery) The "limited fishery" designation is in recognition of the prairie stream aquatic-community type and the 7Q10 low flow of less than 0.1 cfs

CRITERIA OF CONCERN: Dissolved oxygen, ammonia, metals, cyanide, phenol

INSTREAM CRITERIA.
Dissolved oxygen: Water Quality Standards Table A minimum dissolved oxygen criterion is 5 mg/L; however, where natural concentrations fall below that value, 5 mg/L is a minimum average value for the diurnal cycle. Monitoring at other prairie streams and sampling of Clear Fork above Whiteman AFB indicate that early-morning dissolved oxygen may be lower than 5 mg/L under natural low-flow, hot-weather conditions. The Water Quality Standards allow wasteload allocations to be based on these "background" concentrations: 4 mg/L is considered an appropriate warm-weather diurnal minimum for Clear Creek.

Ammonia: A maximum of 2.0 mg/L--warm weather (pH: 7.8; temp: 26 C)
3.2 mg/L--cool weather (pH: 7.8; temp: 8 C)

Other pollutants: (Chronic aquatic-life-protection criteria for limited warm-water fishery; medium water hardness)

Cu-- 43 ug/L
Pb-- 20 ug/L
Zn-- 1505 ug/L
Ag-- .12 ug/L (NOTE: chronic criteria deleted in 1994 Standards)
phenol-- 100 ug/L
CN-- 5 ug/L

Reference: 1991, 1994 Water Quality Standards, Tables A and B

MIXING ZONES: Mixing zones are areas of pollutant dilution and attenuation in classified waters, within which chronic criteria may be exempted. However, in this case, with part of the immediate receiving stream and the first classified stream flowing through a state park, allowance for a mixing zone in Clear Fork is not considered advisable. That is, chronic toxicity criteria should be met in Clear Fork immediately below Brewer Branch.

Reference: 1991 Water Quality Standards

Water Quality Review Sheet
Page Three

In-stream reaeration-decay rates cannot be precisely determined with the generally good effluent quality, and a model for dissolved oxygen and ammonia prediction cannot be accurately calibrated. Estimates were made regarding reaeration and decay rates, and stream morphometry and hydraulics. Inputs were similar to other streams in the area. With these and the observed data, a model was constructed. The recommended effluent limits appear to be necessary to meet dissolved-oxygen and ammonia criteria in Clear Fork, and to assure compliance with stringent antidegradation provisions in both receiving streams

WASTELOAD ALLOCATION LIMITS:

BOD -	June - Sept.	10 mg/L
	Oct. - May	15 mg/L
NH3N -	June - Sept.	2 mg/L
	Oct. - May	3.5 mg/L
NFR -		15 mg/L

EPA guidance recommends that WLA values be used as daily maximum values. However, in this case, there is some uncertainty in the model predictions and considering the present minimal impact on the stream, we recommend that the permit include the following values:

	monthly ave.	weekly ave.	daily max.
BOD			
June - Sept.	10	15	
Oct. - May	15	20	
NFR	15	20	
NH3N			
June - Sept.	2		3
Oct. - May	3.5		4.5

Oil and Grease--same as existing limits.

Effluent limits for other substances limited in the existing permit are:

Cu-- 43 ug/L
Pb-- 20 ug/L
Zn-- 1505 ug/L
Ag-- 8.2 (NOTE: A chronic criterion is no longer included in the 1994 Standards; the acute criterion of 8.2 ug/L should be used.)
phenol- 100 ug/L
Cn-- 5 µg/L (NOTE: The acute criterion of 22 ug/L is acceptable as an effluent limit if WET tests continue to indicate no toxicity and quarterly in-stream monitoring in Clear Creek indicate no values above 5 ug/L.)

The above are based on aquatic-life criteria, "0" flow in the receiving streams, and no loss of metals. Effluent limits should be expressed as "total recoverable" metals (monthly averages. Cyanide should be expressed as "amenable to chlorination".

ATTACHMENTS: Model input and output files

REVIEWER: RG
DATE: 9-13-91 (several subsequent updates compiled on 6-25-96)
SECTION CHIEF: JH, JM

SUMMARY OF TEST METHODOLOGY FOR WHOLE-EFFLUENT TOXICITY TESTS

Whole-effluent-toxicity test required in NPDES permits shall use the following test conditions when performing single or multiple dilution methods. Any future changes in methodology will be supplied to the permittee by the Department of Natural Resources (MDNR). Unless otherwise specified by MDNR, procedures should be consistent with Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms, EPA/600/4-90/027.

Test conditions for Ceriodaphnia dubia:

Test duration:	48 h
Temperature:	$25 \pm 2°C$
Light Quality:	Ambient laboratory illumination
Photoperiod:	16 h light, 8 h dark
Size of test vessel:	30 mL (minimum)
Volume of test solution:	15 mL (minimum)
Age of test organisms:	<24 h old
No. of animals/test vessel:	5
No. of replicates/concentration:	4
No. organisms/concentration:	20 (minimum)
Feeding regime:	None (feed prior to test)
Aeration:	None
Dilution water:	Upstream receiving water; if no upstream flow, synthetic water modified to reflect effluent hardness.
Endpoint:	Mortality (Statistically significant difference from upstream receiving water control at $p \leq 0.05$)
Test acceptability criterion:	90% or greater survival in controls

Test conditions for (Pimephales promelas):

Test duration:	48 h
Temperature:	$25 \pm 2°C$
Light Quality:	Ambient laboratory illumination
Photoperiod:	16 h light/ 8 h dark
Size of test vessel:	250 mL (minimum)
Volume of test solution:	200 mL (minimum)
Age of test organisms:	1-14 days (all same age)
No. of animals/test vessel:	10
No. of replicates/concentration:	4 (minimum) single dilution method 2 (minimum) multiple dilution method
No. of organisms/concentration:	40 (minimum) single dilution method 20 (minimum) multiple dilution method
Feeding regime:	None (feed prior to test)
Aeration:	None, unless DO concentration falls below 4.0 mg/L; rate should not exceed 100 bubbles/min.
Dilution water:	Upstream receiving water; if no upstream flow, synthetic water modified to reflect effluent hardness.
Endpoint:	Mortality (Statistically significant difference from upstream receiving water control at $p \leq 0.05$)
Test Acceptability criterion:	90% or greater survival in controls

APPENDIX 3

12 December 1996 Whiteman AFB, Missouri
Industrial Wastewater System Assessment
Sample Data: Laboratory Analyses

- IWFL

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2402 E DRIVE
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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965000 OEHL SAMPLE NO: 97008452

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	0.002	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	0.042	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	110.328	mg/L	EPA 200.7
Aluminum	1.270	mg/L	EPA 200.7
Iron	0.997	mg/L	EPA 200.7
Magnesium	48.208	mg/L	EPA 200.7
Manganese	0.993	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	10.997	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	0.062	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

TO:

509 AMDS/SGPB
702 8 STREET
WHITEMAN AFB MO 65305-5001

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BASE SAMPLE NO: GN965000 OEHL SAMPLE NO: 97008452

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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BROOKS AFB, TEXAS, 78235-5114

REPORT OF ANALYSIS

BASE SAMPLE NO: GN965000

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008428 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	170	mg/L	EPA 410.4
Total Organic Carbon	30	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008429 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	83.2	mg/L	EPA 413
Total Petroleum Hydroc.	72.0	mg/L	EPA 418.1

TO:

MSGT MARY K. FIELDS PAGE 1

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BASE SAMPLE NO: GN965001 OEHL SAMPLE NO: 97008453

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	<0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	0.036	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	363.697	mg/L	EPA 200.7
Aluminum	1.751	mg/L	EPA 200.7
Iron	0.709	mg/L	EPA 200.7
Magnesium	28.685	mg/L	EPA 200.7
Manganese	0.180	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	15.551	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	0.101	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

TO:

509 AMDS/SGPB
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SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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BASE SAMPLE NO: GN965001

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008430 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	140	mg/L	EPA 410.4
Total Organic Carbon	44.0	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008431 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	51.2	mg/L	EPA 413
Total Petroleum Hydroc.	44.0	mg/L	EPA 418.1

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Date: Mon, 16 Dec 1996 14:17:29 -0600
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BASE SAMPLE NO: GN965002 OEHL SAMPLE NO: 97008454

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	0.0026	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	415.081	mg/L	EPA 200.7
Aluminum	2.582	mg/L	EPA 200.7
Iron	1.353	mg/L	EPA 200.7
Magnesium	23.044	mg/L	EPA 200.7
Manganese	0.202	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	15.889	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	0.044	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

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BASE SAMPLE NO: GN965002 OEHL SAMPLE NO: 97008454

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965002

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008432 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	200	mg/L	EPA 410.4
Total Organic Carbon	35	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008433 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	400	mg/L	EPA 413
Total Petroleum Hydroc.	272	mg/L	EPA 418.1

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965003 OEHL SAMPLE NO: 97008455

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	0.017	mg/L	EPA 200.9
Cadmium	0.282	mg/L	EPA 200.7
Chromium	0.287	mg/L	EPA 200.7
Copper	0.296	mg/L	EPA 200.7
Lead	0.968	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	0.314	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	573.162	mg/L	EPA 200.7
Aluminum	0.552	mg/L	EPA 200.7
Iron	0.518	mg/L	EPA 200.7
Magnesium	53.233	mg/L	EPA 200.7
Manganese	0.370	mg/L	EPA 200.7
Molybdenum	0.258	mg/L	EPA 200.7
Potassium	16.177	mg/L	EPA 200.7
Silver	0.221	mg/L	EPA 200.7
Zinc	0.315	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

TO:

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10/96 PAGE 1(Cont'd)

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965003 OEHL SAMPLE NO: 97008455

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965003

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008434 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	1130	mg/L	EPA 410.4
Total Organic Carbon	445	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008435 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	88.0	mg/L	EPA 413
Total Petroleum Hydroc.	72.0	mg/L	EPA 418.1

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MSGT MARY K. FIELDS PAGE 1

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Date: Mon, 16 Dec 1996 14:18:20 -0600
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BASE SAMPLE NO: GN965004 OEHL SAMPLE NO: 97008456

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	110.383	mg/L	EPA 200.7
Aluminum	0.953	mg/L	EPA 200.7
Iron	0.724	mg/L	EPA 200.7
Magnesium	43.543	mg/L	EPA 200.7
Manganese	0.851	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	10.323	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	0.062	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

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BASE SAMPLE NO: GN965004 OEHL SAMPLE NO: 97008456

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

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Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965004

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008436 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	240	mg/L	EPA 410.4
Total Organic Carbon	35	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008437 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	88.8	mg/L	EPA 413
Total Petroleum Hydroc.	64.0	mg/L	EPA 418.1

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id AA292487510; Mon, 16 Dec 1996 14:18:30 -0600
Date: Mon, 16 Dec 1996 14:18:30 -0600
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BASE SAMPLE NO: GN965005 OEHL SAMPLE NO: 97008457

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	<0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	355.851	mg/L	EPA 200.7
Aluminum	0.631	mg/L	EPA 200.7
Iron	0.252	mg/L	EPA 200.7
Magnesium	25.637	mg/L	EPA 200.7
Manganese	0.142	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	14.387	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	<0.050	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965005 OEHL SAMPLE NO: 97008457

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

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Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965005

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008438 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	10	mg/L	EPA 410.4
Total Organic Carbon	25	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008439 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	70.4	mg/L	EPA 413
Total Petroleum Hydroc.	56.0	mg/L	EPA 418.1

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BASE SAMPLE NO: GN965006 OEHL SAMPLE NO: 97008458

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	<0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	384.351	mg/L	EPA 200.7
Aluminum	0.655	mg/L	EPA 200.7
Iron	0.302	mg/L	EPA 200.7
Magnesium	29.535	mg/L	EPA 200.7
Manganese	0.128	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	15.469	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	<0.050	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

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REPORT OF ANALYSIS

BASE SAMPLE NO:	GN965006	OEHL SAMPLE NO:	97008458
SAMPLE TYPE:	NON-POTABLE WATER		
SITE IDENTIFIER:	CEIN140A	DATE RECEIVED:	961213
DATE COLLECTED:	961212	DATE REPORTED:	961218
DATE ANALYZED:	961218		
PROJECT ID:	WHITE-1		

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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BASE SAMPLE NO: GN965006

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008440 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	20	mg/L	EPA 410.4
Total Organic Carbon	20	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008441 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	72.0	mg/L	EPA 413
Total Petroleum Hydroc.	70.4	mg/L	EPA 418.1

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BASE SAMPLE NO: GN965007 OEHL SAMPLE NO: 97008459

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	0.007	mg/L	EPA 200.9
Cadmium	<0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	442.669	mg/L	EPA 200.7
Aluminum	0.231	mg/L	EPA 200.7
Iron	0.180	mg/L	EPA 200.7
Magnesium	31.408	mg/L	EPA 200.7
Manganese	0.142	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	15.230	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	<0.050	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

TO:

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702 8 STREET
WHITEMAN AFB MO 65305-5001

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BASE SAMPLE NO: GN965007 OEHL SAMPLE NO: 97008459

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965007

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008442 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	150	mg/L	EPA 410.4
Total Organic Carbon	125	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008443 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	27.2	mg/L	EPA 413
Total Petroleum Hydroc.	16.0	mg/L	EPA 418.1

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BASE SAMPLE NO: GN965008 OEHL SAMPLE NO: 97008460

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	121.912	mg/L	EPA 200.7
Aluminum	0.809	mg/L	EPA 200.7
Iron	0.597	mg/L	EPA 200.7
Magnesium	46.115	mg/L	EPA 200.7
Manganese	0.920	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	11.805	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	<0.050	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

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702 8 STREET
WHITEMAN AFB MO 65305-5001

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965008 OEHL SAMPLE NO: 97008460

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965008

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008444 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	300	mg/L	EPA 410.4
Total Organic Carbon	25	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008445 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	64.0	mg/L	EPA 413
Total Petroleum Hydroc.	48.0	mg/L	EPA 418.1

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BASE SAMPLE NO: GN965009 OEHL SAMPLE NO: 97008461

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	<0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	330.178	mg/L	EPA 200.7
Aluminum	0.052	mg/L	EPA 200.7
Iron	0.047	mg/L	EPA 200.7
Magnesium	29.611	mg/L	EPA 200.7
Manganese	0.068	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	13.540	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	<0.050	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

TO:

509 AMDS/SGPB
702 8 STREET
WHITEMAN AFB MO 65305-5001

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965009 OEHL SAMPLE NO: 97008461

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965009

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008446 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	180	mg/L	EPA 410.4
Total Organic Carbon	25	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008447 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	11.2	mg/L	EPA 413
Total Petroleum Hydroc.	8.0	mg/L	EPA 418.1

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MSGT MARY K. FIELDS PAGE 1

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Return-Path: <HASLEY@labux.brooks.af.mil.brooks.af.mil>
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id AA293297579; Mon, 16 Dec 1996 14:19:39 -0600
Date: Mon, 16 Dec 1996 14:19:39 -0600
From: HASLEY@labux.brooks.af.mil.brooks.af.mil
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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965010 OEHL SAMPLE NO: 97008462

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	<0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	343.173	mg/L	EPA 200.7
Aluminum	0.159	mg/L	EPA 200.7
Iron	0.110	mg/L	EPA 200.7
Magnesium	28.808	mg/L	EPA 200.7
Manganese	0.086	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	13.373	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	<0.050	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

TO:

509 AMDS/SGPB
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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965010 OEHL SAMPLE NO: 97008462

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965010

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008448 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	60	mg/L	EPA 410.4
Total Organic Carbon	20	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008449 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	16.0	mg/L	EPA 413
Total Petroleum Hydroc.	14.4	mg/L	EPA 418.1

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    id AA293377593; Mon, 16 Dec 1996 14:19:53 -0600
Date: Mon, 16 Dec 1996 14:19:53 -0600
From: HASLEY@labux.brooks.af.mil.brooks.af.mil
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BASE SAMPLE NO: GN965011 OEHL SAMPLE NO: 97008463

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: CEIN140A DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961218

DATE ANALYZED: 961218

PROJECT ID: WHITE-1

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method
Arsenic	<0.005	mg/L	EPA 200.9
Cadmium	<0.001	mg/L	EPA 200.7
Chromium	<0.010	mg/L	EPA 200.7
Copper	<0.020	mg/L	EPA 200.7
Lead	<0.020	mg/L	EPA 200.7
Mercury	<0.0002	mg/L	EPA 245.2
Nickel	<0.020	mg/L	EPA 200.7
Selenium	<0.005	mg/L	EPA 200.9
Sodium	383.021	mg/L	EPA 200.7
Aluminum	0.204	mg/L	EPA 200.7
Iron	0.064	mg/L	EPA 200.7
Magnesium	25.496	mg/L	EPA 200.7
Manganese	0.073	mg/L	EPA 200.7
Molybdenum	<0.030	mg/L	EPA 200.7
Potassium	13.937	mg/L	EPA 200.7
Silver	<0.010	mg/L	EPA 200.7
Zinc	<0.050	mg/L	EPA 200.7

Comments:

SAMPLE SPIKE RECOVERIES ARE LOW DUE TO ALKALINE COMPOSITION OF SAMPLE.
< - Signifies none detected and the detection limits.

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REPORT OF ANALYSIS

BASE SAMPLE NO:	GN965011	OEHL SAMPLE NO:	97008463
SAMPLE TYPE:	NON-POTABLE WATER		
SITE IDENTIFIER:	CEIN140A	DATE RECEIVED:	961213
DATE COLLECTED:	961212	DATE REPORTED:	961218
DATE ANALYZED:	961218		
PROJECT ID:	WHITE-1		

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

RESULTS

Test	Results	Units	Method

Reviewed by: Paul G. Randolph Jr., GS-12
Chemist, Metal Analysis Function

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REPORT OF ANALYSIS

BASE SAMPLE NO: GN965011

SAMPLE TYPE: NON-POTABLE WATER

SITE IDENTIFIER: DATE RECEIVED: 961213

DATE COLLECTED: 961212 DATE REPORTED: 961216

DATE ANALYZED: 961213

SAMPLE SUBMITTED BY: MSGT MARY K. FIELDS

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008450 ANALYSIS DATE: 961213

Test	Results	Units	Method
Chemical Oxygen Demand	340	mg/L	EPA 410.4
Total Organic Carbon	50	mg/L	EPA 415.1

PRESERVATION GROUP A, B, C OEHD SAMPLE #: 97008451 ANALYSIS DATE: 961213

Test	Results	Units	Method
Oil and Grease	88.0	mg/L	EPA 413
Total Petroleum Hydroc.	80.8	mg/L	EPA 418.1

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Date: Mon, 16 Dec 1996 14:20:09 -0600
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